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ON INDUSTRY ✪ IN TRANSPORTATION • ON THE SEA • IN THE AIR ✪

DIESEL PROGRESS

MECHANICAL ENGINEERING DEPARTMENT
AUG 11 1938
GOODS

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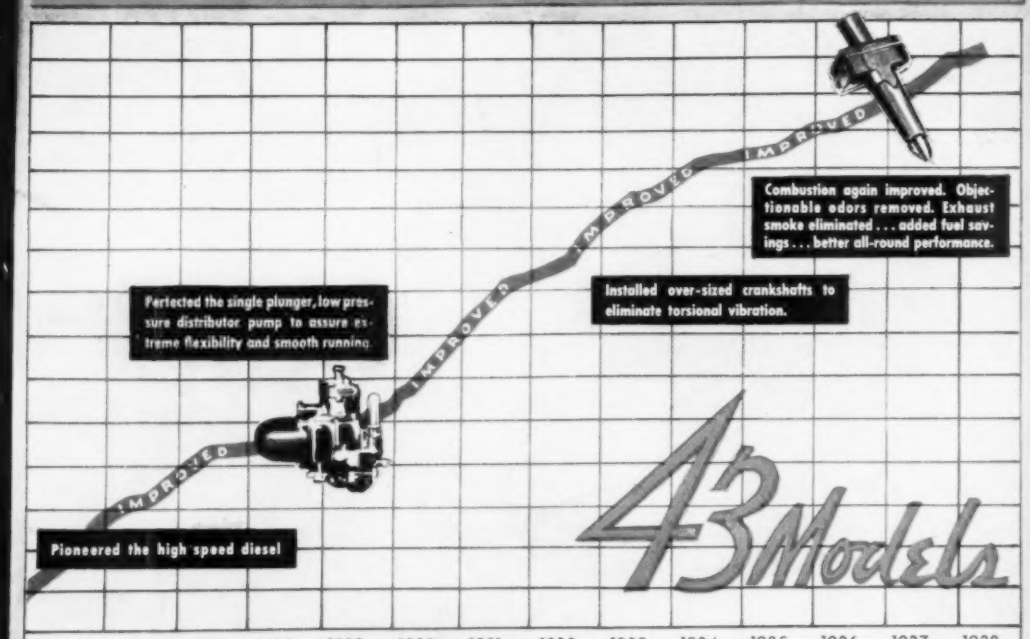
AUGUST, 1938 CIRCULATION OF THIS ISSUE — IN EXCESS OF 14,000 COPIES 25c

No Recession


IMPROVED
IMPROVED
IMPROVED
Pioneered the high speed diesel
Perfected the single plunger, low pressure distributor pump to assure extreme flexibility and smooth running.
Installed over-sized crankshafts to eliminate torsional vibration.
Combustion again improved. Objectionable odors removed. Exhaust smoke eliminated . . . added fuel savings . . . better all-round performance.
43 Models
1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938

CUMMINS
Dependable
DIESEL
PIONEER IN MODERN DIESEL DEVELOPMENT

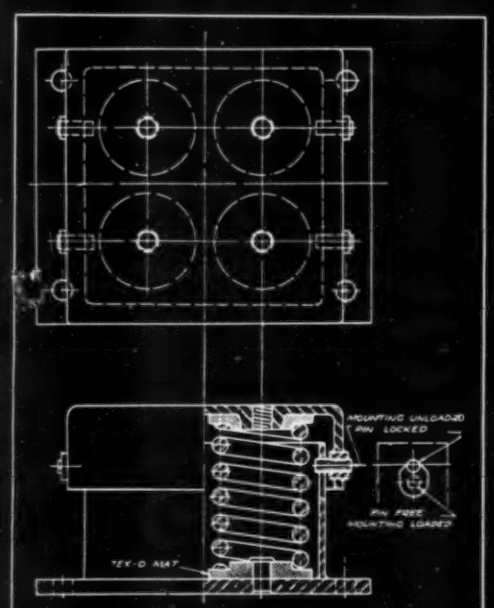
MEMO • FROM C. L. CUMMINS

Cummins Improvement knows no recession. If we built a diesel engine to serve, creditably, only one or two industries, the "improvement curve" might have levelled off. But the use of the Cummins Diesel is as widespread and varied as industry itself . . . the power need of each industry has become a separate test block of its own.

Whatever your power need (industrial, automotive, or marine) remember this: The Cummins Diesel has been field-tested and field-approved, not only in the use to which you will put it, but in the widest variety of power applications ever given ANY diesel engine.

C. L. Cummins PRESIDENT
CUMMINS ENGINE COMPANY, COLUMBUS, INDIANA

DIESEL PROGRESS for August, 1938. Volume IV, No. 8. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Possessions $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U. S. A., 50 cents for all other countries.



Type U Hussman Unit Mounting
Load Range 3000/5000 Lbs.

WHY

HUSSMAN · SPRING · MOUNTINGS

PRODUCE EXCEPTIONAL RESULTS IN ELIMINATING VIBRATIONS

HUSSMAN • SPRING • MOUNTINGS are designed and built to fulfill all of the requirements essential for complete and permanent Isolation of Machinery Vibrations. They are:

1 **ANALYSIS · INDIVIDUAL**

All factors which determine the design and the application of the Mounting, such as weight of the machine, its speed, horsepower and center of gravity, its unbalanced forces and moments, the condition of the sub-structure, the nature of the soil, etc., all are carefully taken into consideration. Not a Stock Proposition, but an Individual Engineering Product, designed to suit the physical characteristics of the machine to be isolated, and the prevailing, general conditions.

2 **SPRINGS · PROPERLY DESIGNED · CORRECTLY APPLIED**

The Springs are designed for the lowest frequencies of the forced engine vibrations, with frequency ratios sufficiently high for maximum efficiency. The application is such that they are allowed full freedom to develop their elastic properties in all directions, without interference, without blocking, without lateral constraint, resulting in isolating efficiencies approaching 100 percent. The possibilities of fatigue, or breakage, are non-existing, by proper design of the spring and the selection of the proper material, with correct heat-treatment, so that safety factors are obtained which exceed by far the requirements of normal operation.

3 **OPERATING AMPLITUDE · UNDER CONTROL**

As stated, the springs are not harnessed by lateral constraint for the purpose of stabilization, a method which interferes with their natural function and reduces their efficiency as a vibration isolator. Control of the Amplitude of Motion of the running Engine is obtained by the • VISCO-STABILIZER •, a patented device which keeps the motion of the machine well within the limits allowed for safety and satisfactory operation, even during the periods of resonance, through which the engine must pass, in starting and stopping. This device is of particular value for marine applications, where additional provision must be made, to counteract the overturning moments of the set, while the ship pitches and rolls in a heavy sea, without impairing safety and reducing the isolating effect of the Mounting.

4 **PERFORMANCE · PERMANENT**

The absence of cork, felt, rubber, or any other material of the organic class, renders HUSSMAN • SPRING • MOUNTINGS immune against water, oil, or other influences. Welded-steel-construction, is used throughout, insuring great durability, and maximum strength, combined with minimum weight. Simple to install, as no adjustments are necessary, in the field.

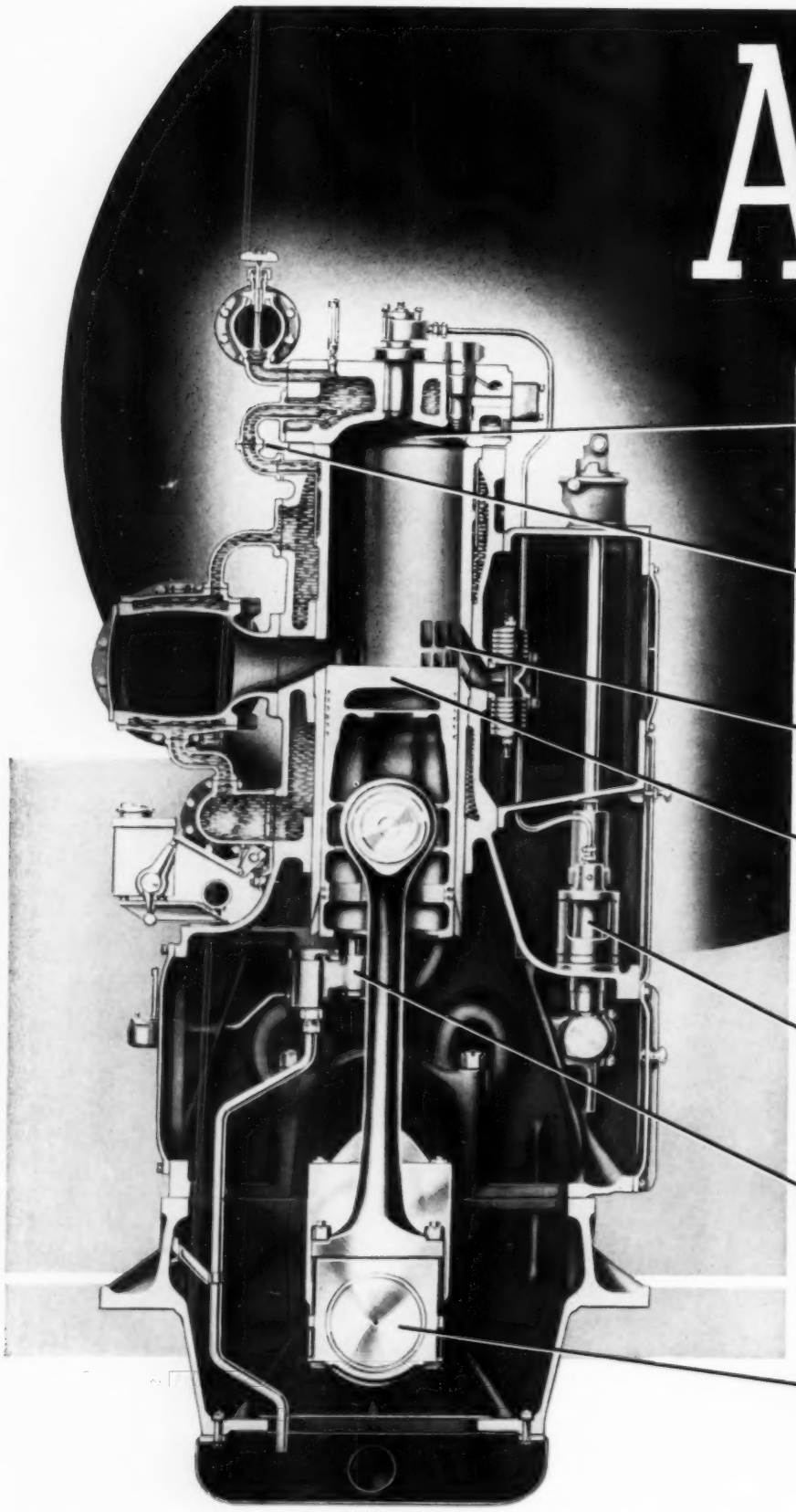
Sold with the specific Guarantee, of your complete satisfaction.

CARL HUSSMAN

Specialist in solving vibration problems

120 SOUTH LA SALLE ST., CHICAGO, ILL.

ALCO



❶ Cylinder Head of simplest possible shape, eliminating possibility of cracks from uneven expansion.

❷ Outside Water Connection, eliminating all leaks to combustion chamber.

❸ Double row of Ports, providing full cylinder charge of clean air.

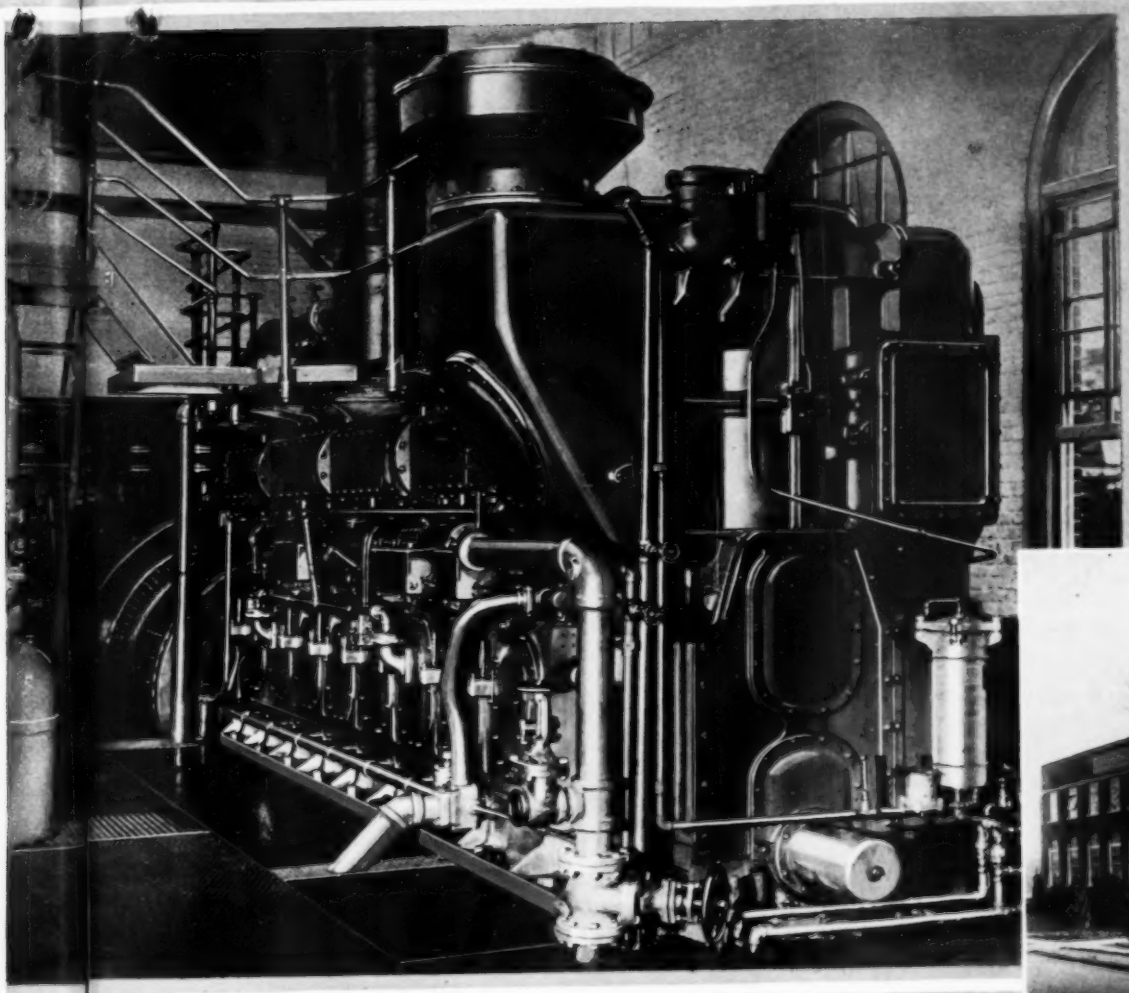
❹ Perfectly flat and smooth Piston Crown, guaranteeing long life of metal and smallest heat losses through piston.

❺ Alco-Sulzer Fuel Pumps readily accessible during operation of engine.

❻ Rugged Telescope Pipe for Piston Cooling, insuring dependable cooling of piston crown under all conditions.

❼ Crank Pin and Main Bearing Shells interchangeable and amply dimensioned.

-SULZER..



To carry an increased load, a 1,480-hp., 8-cylinder, Alco-Sulzer, two-cycle, Diesel has been placed in service at the Hudson, Mass., Municipal Light Plant.

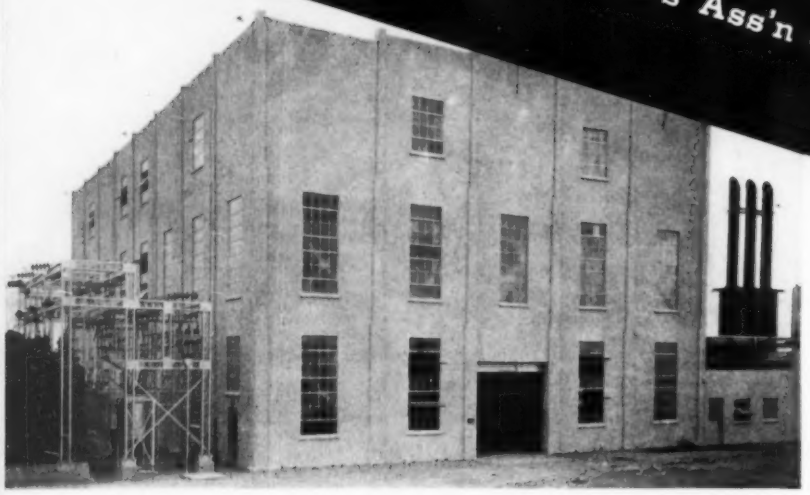
Alco DIESEL ENGINE DIVISION

AMERICAN LOCOMOTIVE COMPANY

30 CHURCH STREET NEW YORK CITY

ERIE

An Erie crankshaft in this eight cylinder Hamilton M. A. N. engine, built by Hooven, Owens, Rentschler Division of General Machinery Corporation for the Salt River Water Users' Ass'n of Phoenix, Arizona.

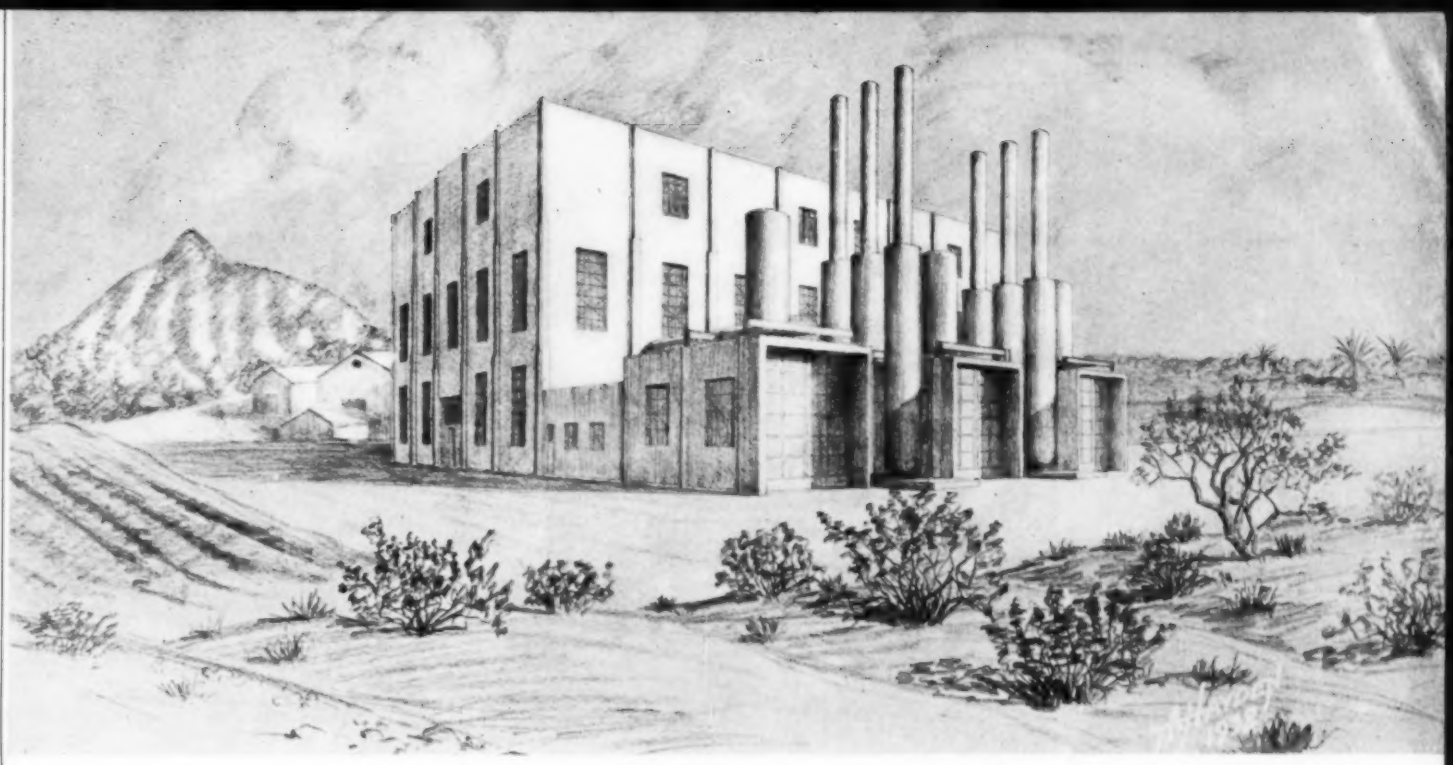


An important factor of dependability in this large engine is the Erie crankshaft.

ROUGH and finished connecting rods, piston rods, crossheads, generator and extention shafts for all classes of stationary and marine engines.

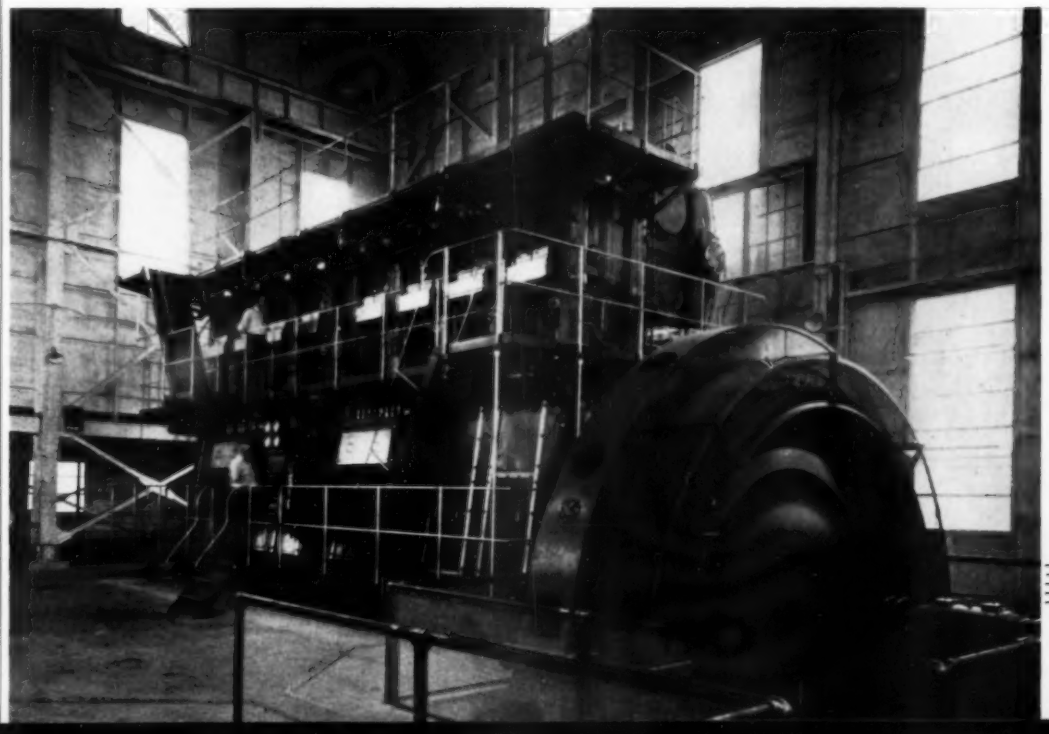
ERIE FORGE CO.

ERIE, PENNSYLVANIA

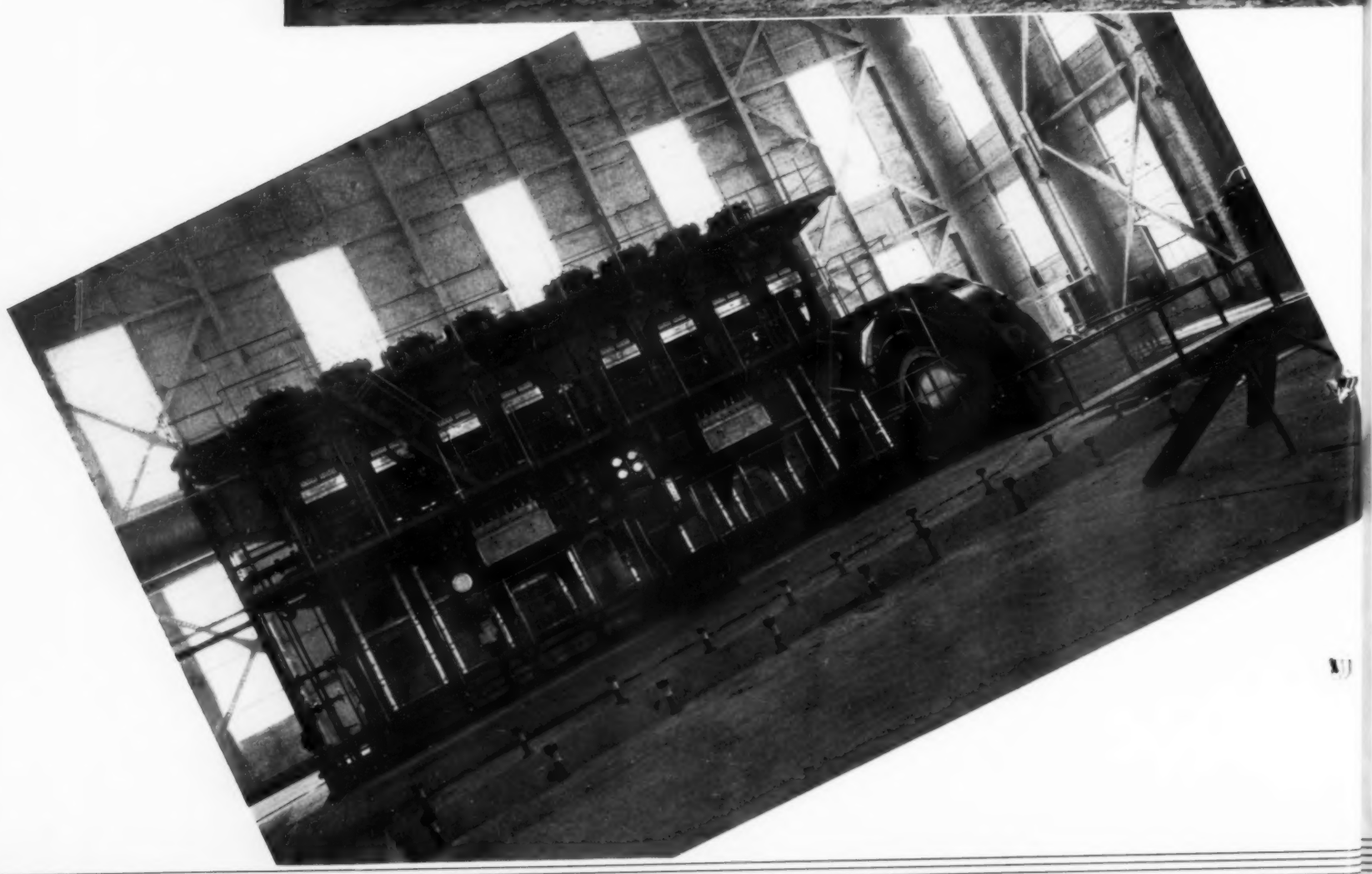


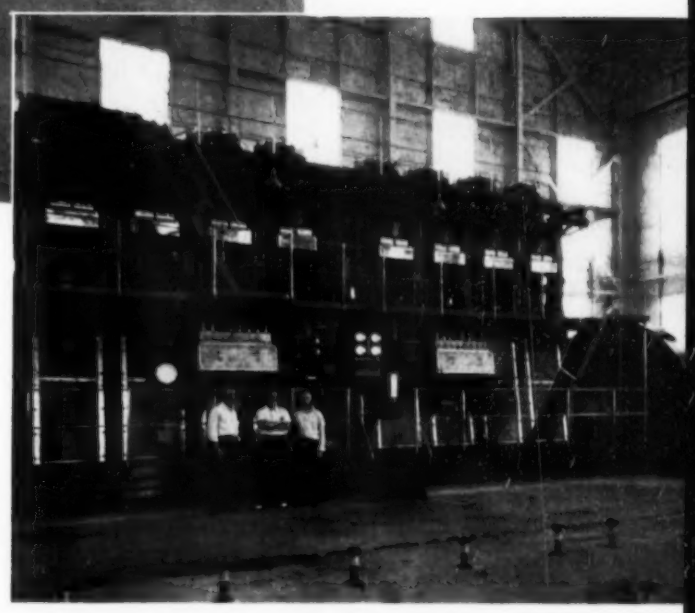
7000 H. P.
HAMILTON - M. A. N.
FOR PHOENIX

A 7000 hp. HAMILTON-M.A.N. Diesel Engine, the largest ever built in the U.S.A., is now successfully operating in the Tempe, Ariz., plant of the Salt River Valley Water Users' Association of Phoenix, Arizona.



Generator end of the 7000 hp. HAMILTON-M.A.N. Diesel Engine at Tempe, Ariz., showing the 25 cycle, 6250 kva. General Electric generator.

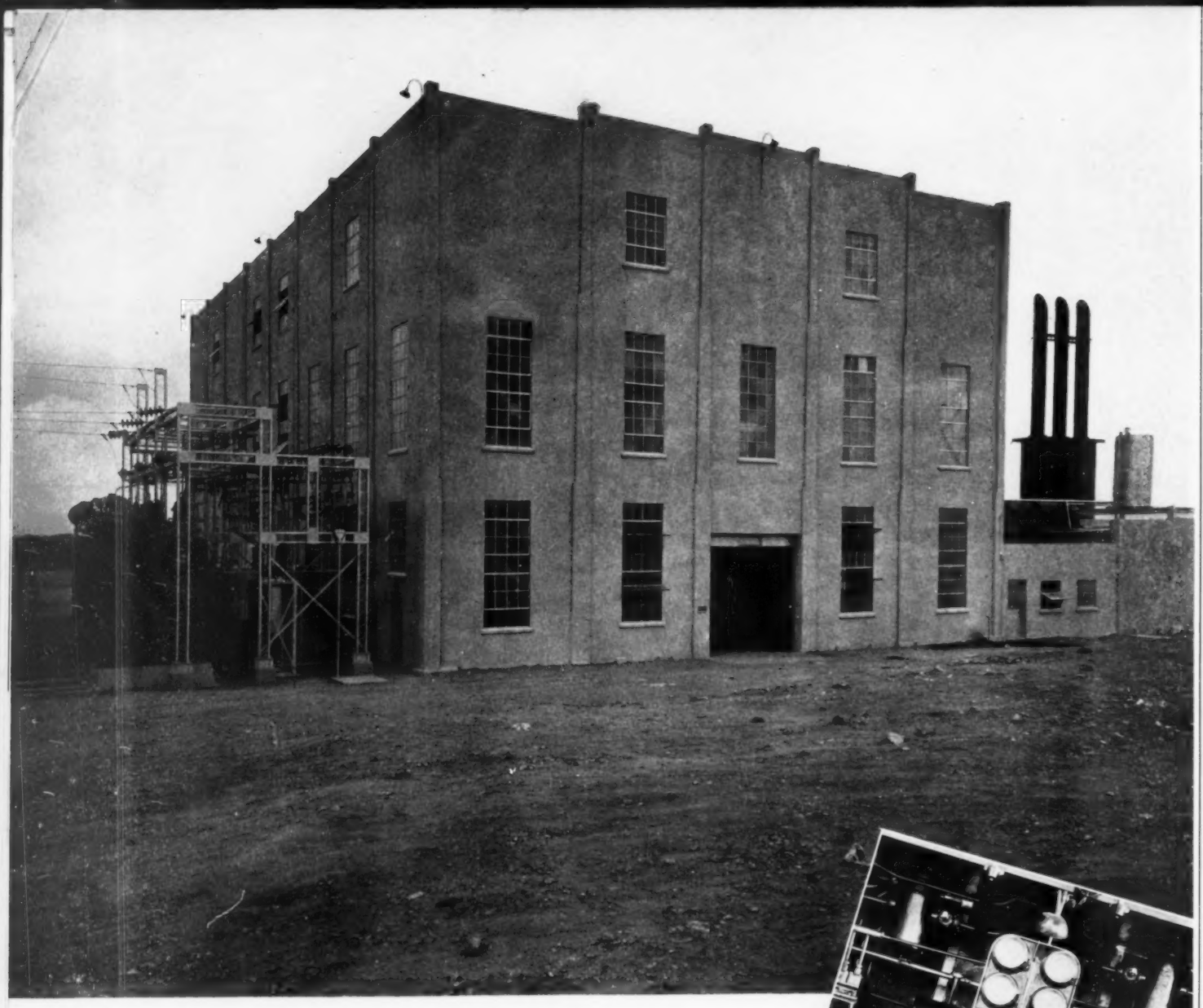


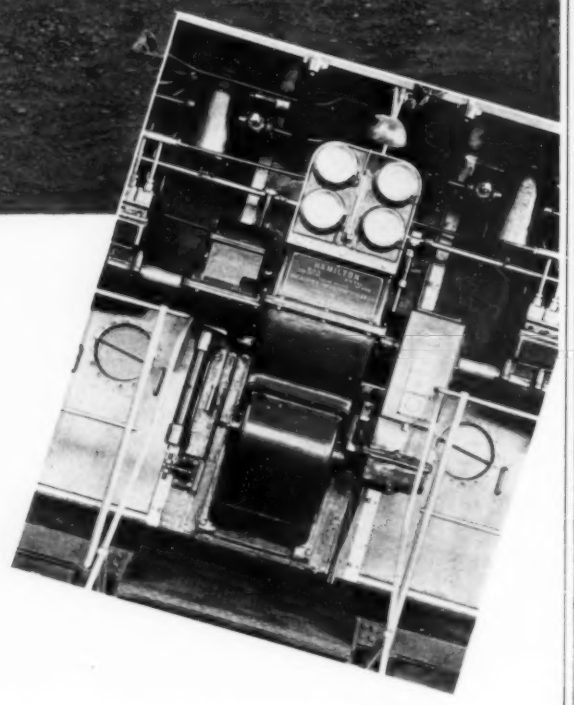


The three men standing in front of this engine makes possible a visualization of the tremendous size of this 7000 hp. HAMILTON-M.A.N. Diesel engine. The largest single unit built in this country. Five similar units were built, seven years ago, for Vernon, Calif., Municipal power plant.

Illustrated above is a general view of the Diesel plant at Tempe, Ariz., of the Salt River Valley Water Users' Association. The first 7000 hp. HAMILTON-M.A.N. Diesel engine is now installed and successfully operating. Foundations for a second engine of the same size and make, due for delivery this September, are shown in photo to the left. The building, as now erected, is large enough for three units and sufficient ground in the rear has been allowed for the possible installation of five similar engines, for a total installed capacity of 56,000 hp.

A detailed description of this, the largest unit engine installation built in the U.S.A., appears in an eight page article in the editorial section of this issue on pages 24 to 31.





Front view of Tempe, Ariz., Diesel Plant and close-up of operating platform of the 7000 hp. HAMILTON-M.A.N. Diesel engine.

In addition to manufacturing this 7000 H.P. HAMILTON-M.A.N. double acting, two cycle Diesel Engine, which is offered in various cylinder units, we also manufacture a line of single acting, two cycle HAMILTON-M.A.N. Diesels rated at 250 kw. per cylinder. Three 3-cylinder units of this type are now operating at Brawley, Calif., for the Imperial Irrigation District and three 6-cylinder units of this same size are now under construction for this same plant.

HAMILTON - M. A. N.

GENERAL MACHINERY CORPORATION

Hooven, Owens, Rentschler Division

Hamilton, Ohio

SKILL
LIKE NICK'S BUILDS
LONG LIFE INTO EVERY
G-E GENERATOR

Meet "NICK"

Expert Armature Winder

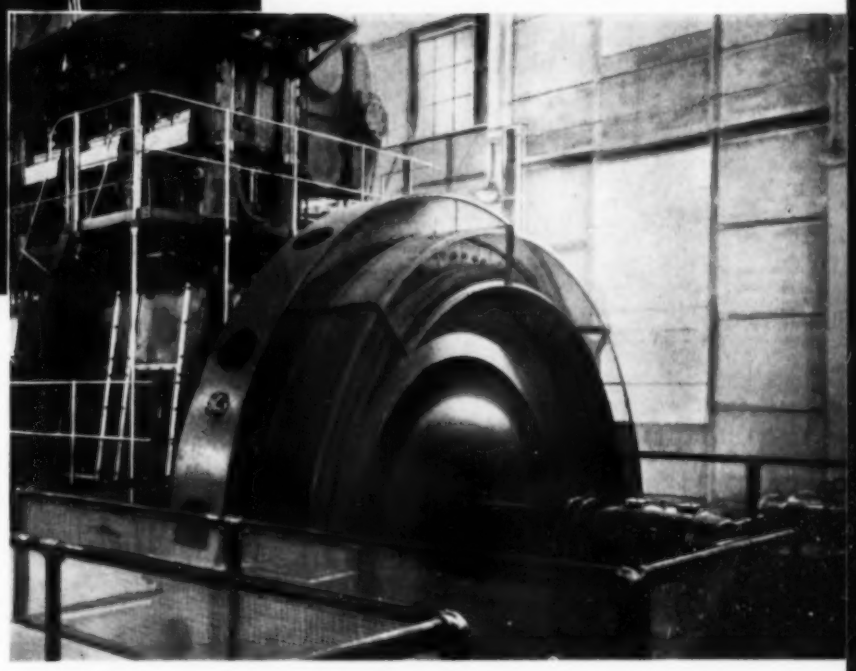
He's Typical of the Skilled G-E Craftsmen Who Built This Generator

OLIVER J. NICKLAW has worked on G-E generators since 1899. He put the first joint coils in the giant generators at Boulder Dam, has assembled and rebuilt generators in nearly every state and in India, Canada, Norway, Mexico, and Indo-China. Asked what part of the world he likes best, Nick smiles, says he believes it's Schenectady, where he owns his home, has his yard full of Paul's Scarlet Climber roses and regal lilies

GLOBE-TROTTER O. J. Nicklaw, better known as "Nick," is one of the skilled G-E workmen who built the new generator shown at the right. Thirty-nine years with General Electric, he's worked on all sizes of generators in our shops and customers' plants at home and abroad.

Once he rebuilt four giant generators in India with the help of only native labor directed through an interpreter. For that he received, in 1924, the Charles A. Coffin Foundation Award, coveted honor given by General Electric for especially meritorious service.

In our shops Nick assembles coils into generator slots, wedges them in place, braces the end portions, connects the proper phase groups, and then insulates the connections. Extreme skill and care are necessary at every step if the generator is to last a long time with little maintenance. Nick helps make sure that it will.



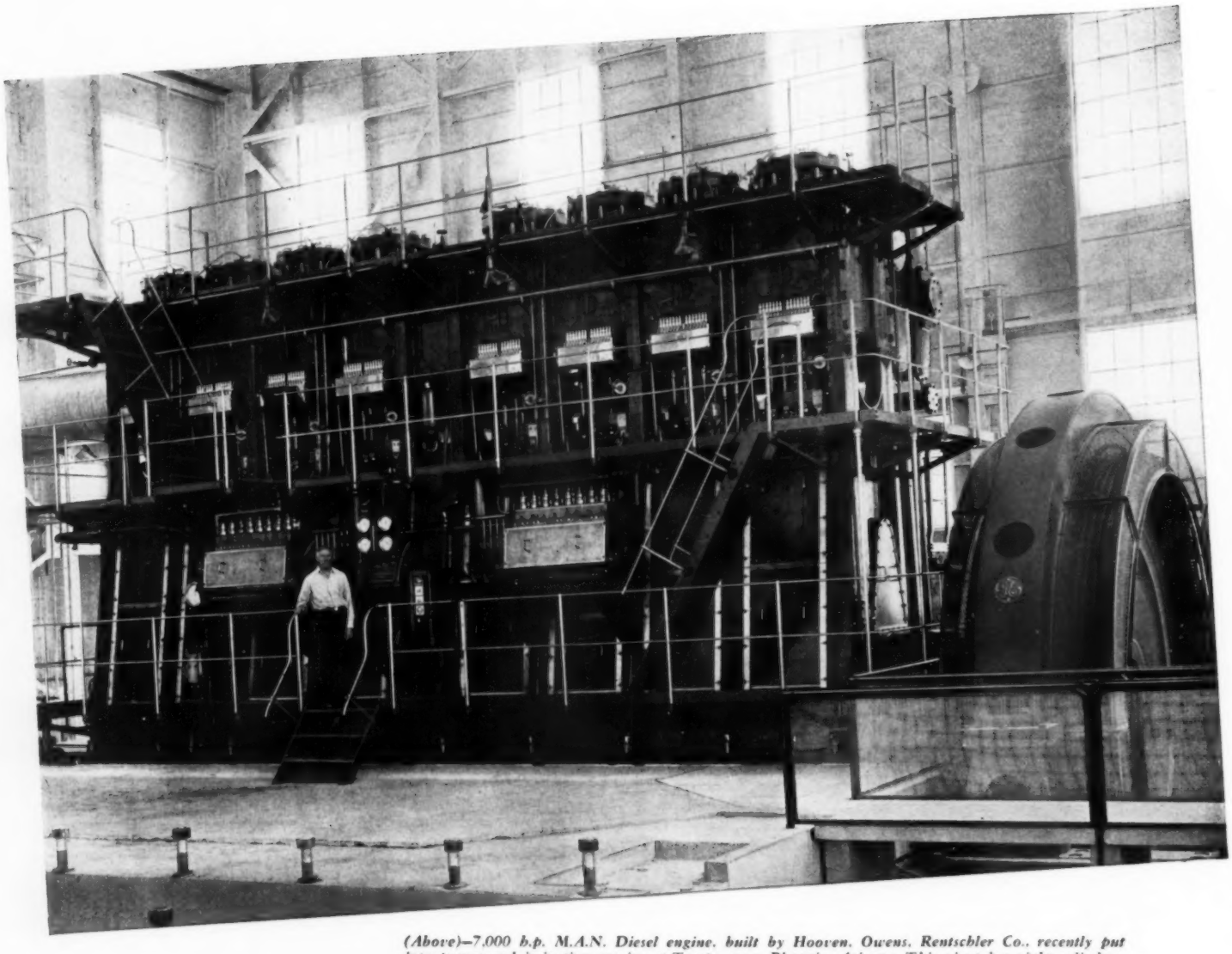
LARGEST 25-cycle engine-driven generator in the United States. This G-E generator, along with G-E voltage regulators and switchgear, has just been installed in the power station of the Salt River Water Users' Association at Tempe, Arizona. It is rated 6250 kva at 167 rpm, 6600 volts. The same type of careful workmanship that built it goes into even the smallest G-E generator

Equally careful craftsmanship goes into the production of all G-E equipment. No matter what type you need, when you specify General Electric the skilled work of experts like Nick goes into its construction. General Electric Company, Schenectady, New York.

GENERAL ELECTRIC

040-59

LARGEST DIESEL



(Above)—7,000 b.p. M.A.N. Diesel engine, built by Hooven, Owens, Rentschler Co., recently put into power and irrigation service at Tempe, near Phoenix, Arizona. This giant has eight cylinders, and is of two-stroke, double acting design. Biggest Diesel built in several years . . . lubricated with Texaco exclusively.

(Right)—General view of Tempe plant of Salt River Valley Water Users Association, big power and irrigation service organization. Thomas M. McComb, Supt. The giant cactus in the foreground is the "saguaro."

TEXACO

REG. T. M.

TEXACO

BUILT IN YEARS

ADOPTS TEXACO

RECENTLY INSTALLED as a stand-by and booster unit of the Salt River Valley Water Users Association, it's one of the largest Diesels operating in the Western Hemisphere, and lubricated 100% with Texaco.

Overall dimensions are 56 feet long, 22½ feet high, weighing 350 tons, the eight cylinders are each 24 inches in diameter, 36-inch stroke.

Keeping moving parts efficient in this huge Diesel makes effective lubrication vitally important. Knowing this, the engineers in charge chose Texaco.

Texaco Ursa Oil is used for lubrication of cylinders and Texaco Algol Oil in the crankcase, assuring freedom from harmful carbon, sludging, frequent cleaning.

Trained lubrication engineers will help you select the right lubricants for *your* Diesels. 2108 Texaco warehouse plants assure prompt delivery, wherever you may be. Wire, phone or write:

The Texas Company, 135 East 42nd St., New York City.

Algol AND *Ursa* *OILS*

SAVES MONEY!

"RPM" Diesel Engine Lubricating Oil saves money for "Caterpillar" Diesel operators everywhere. The *first* non-ring-sticking oil ever developed for "Caterpillar" Diesel engines—today more of it is being sold and used in these engines than all other Diesel oils combined. It can save *you* money, too—by eliminating periodic overhauls—by minimizing power-losses—by reducing non-operating hours—by giving you outstanding lubrication performance.

The World's 1st Choice

FOR "CATERPILLAR" DIESEL ENGINE LUBRICATION

"RPM" Diesel Engine Lubricating Oil is distributed by the following companies under the brand names indicated:

IN THE UNITED STATES

"RPM" Diesel Engine Lubricating Oil:
THE CALIFORNIA COMPANY (Montana only)
THE CARTER OIL COMPANY, Tulsa, Oklahoma
HUMBLE OIL & REFINING COMPANY
STANDARD OIL COMPANY (Indiana)
STANDARD OIL COMPANY (Inc. in Kentucky)
STANDARD OIL COMPANY (Nebraska)
STANDARD OIL COMPANY OF CALIFORNIA
STANDARD OIL COMPANY OF TEXAS
UTAH OIL REFINING COMPANY

Diol "RPM" Diesel Engine Lubricating Oil:
COLONIAL BEACON OIL COMPANY, INC.
STANDARD OIL COMPANY OF LOUISIANA
STANDARD OIL COMPANY OF NEW JERSEY
STANDARD OIL COMPANY OF PENNSYLVANIA

Signal "RPM" Diesel Engine Lubricating Oil:
SIGNAL OIL COMPANY

Sohio "RPM" Diesel Engine Lubricating Oil:
THE STANDARD OIL COMPANY (Ohio)

IN CANADA

"RPM" Diesel Engine Lubricating Oil:
IMPERIAL OIL LIMITED
STANDARD OIL COMPANY OF BRITISH COLUMBIA LIMITED

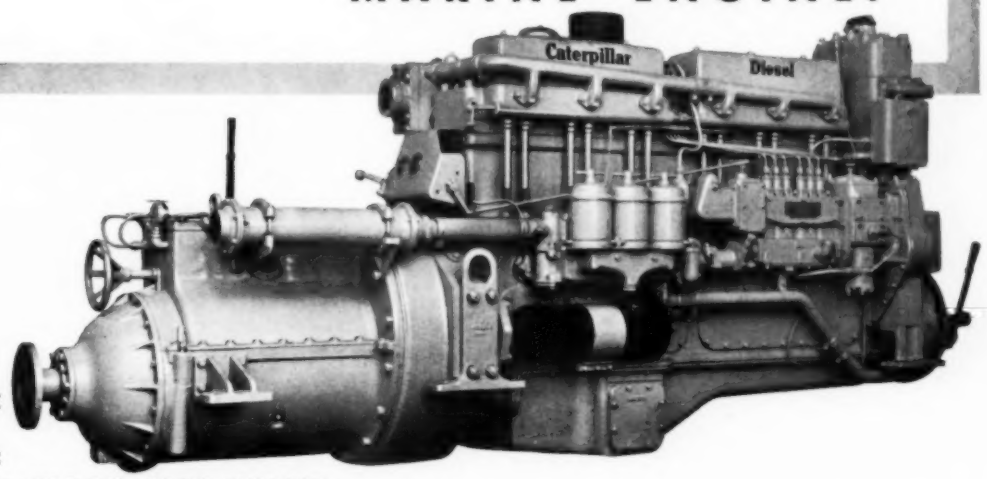
THROUGHOUT THE WORLD

"RPM" Diesel Engine Lubricating Oil is also available through distributors in more than 100 other countries.

STANDARD OIL COMPANY OF CALIFORNIA

AND NOW...

A "CATERPILLAR" DIESEL MARINE ENGINE!



THE "CATERPILLAR" DIESEL MARINE ENGINE IS AVAILABLE IN THESE THREE SIZES:

8 CYLINDERS — 5¾" x 8" — 900 R. P. M. 135 BHP. HEAVY DUTY
6 CYLINDERS — 5¾" x 8" — 900 R. P. M. 100 BHP. HEAVY DUTY
6 CYLINDERS — 5¼" x 8" — 900 R. P. M. 80 BHP. HEAVY DUTY

The "Fannie D"—well known in the waters around Houston and Galveston, Texas. Powered by a 6-cylinder "Caterpillar" Diesel Engine. The "Fannie D" is 41 feet in length. Three-blade propeller: 44 inches in diameter by 28-inch pitch.

The "Diamond"—a twin-screw, tunnel-type river towboat—55 feet in length, 16 feet over-all width and 26-inch draft—the two propellers are 42 inches in diameter with 30-inch pitch turning at 425 R.P.M. Powered by two 6-cylinder "Caterpillar" Diesel Engines.

WHEN boat owners go to the trouble and expense of converting standard "Caterpillar" Diesel power-units to marine use, you can bet they feel confident of *saving money* in the end.

And that is exactly how it has worked out! Numerous "Caterpillar" Diesels ("marined" at the owners' own expense) have been in operation for several years . . . and proved that these world-famous engines give outstanding *economy* and *dependability* on the water.

In fact, the success of such converted "Caterpillar" Diesels has resulted in an increasing and insistent demand for a *factory-built* "Caterpillar" Diesel Marine Engine!

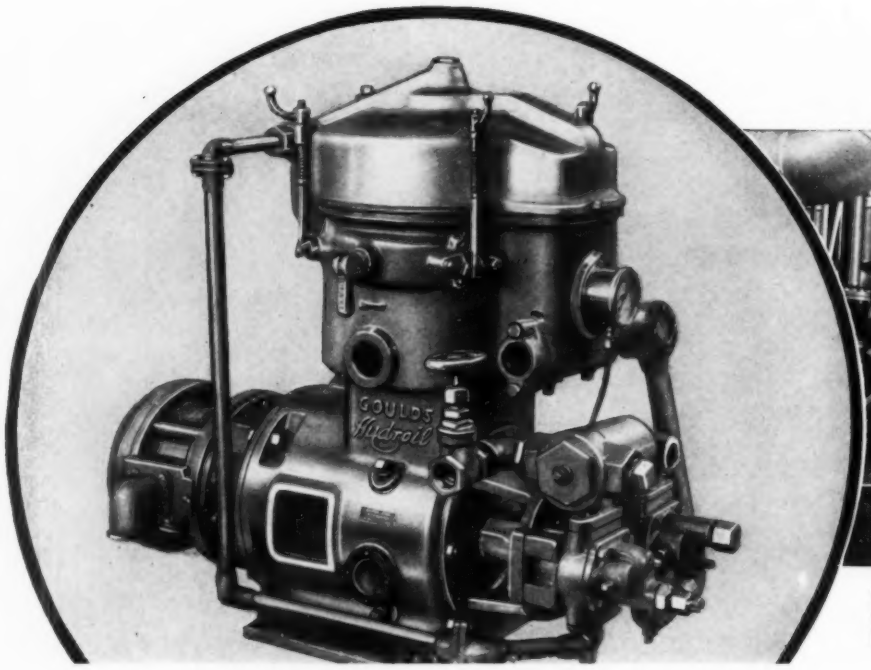
We accept the urge of progress, and now offer such an engine in three sizes . . . each designed and built to operate continuously at full load, under the most severe conditions at rated horsepower. They are suitable for driving either right or left-hand propellers. Fresh-water jacket cooling with integral heat exchanger is standard equipment.

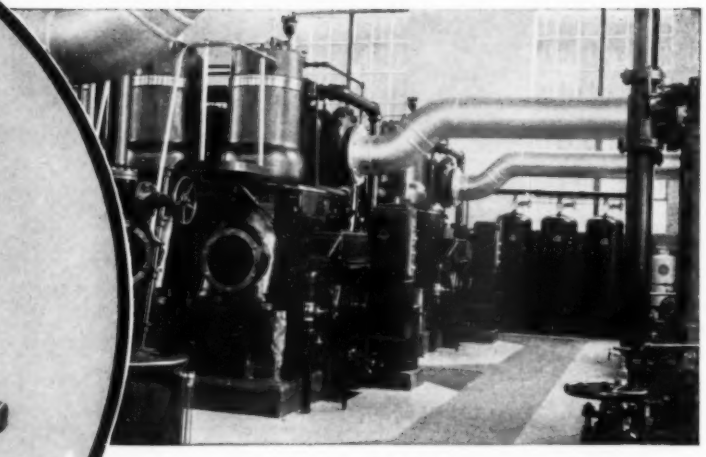
Backing up the "Caterpillar" quality of these engines is "Caterpillar" world-wide service — the most complete and readily available of any Diesel engine manufacturer! See your nearest "Caterpillar" dealer, or write direct, for more information about the "Caterpillar" Diesel Marine Engine.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

CATERPILLAR
REG. U.S. PAT. OFF.
DIESEL POWER

DIESEL ENGINES • DIESEL-ELECTRIC GENERATOR SETS





This view of the general engine room of the Seaford Light & Power Co. shows three Fairbanks-Morse Diesels lubricated with oil cleaned by Goulds Hydroil Purifiers.

• • • IN THIS MODERN PLANT

GOULDS HYDROILS

ARE SERVING AND SAVING

THE SEAFORD LIGHT & POWER CO. recently built a new 600-kw. Diesel generating plant to serve the citizens of Seaford, Del.

Engineers designed this ultra-modern plant to give continuous, effective service to its customers. They knew that good lubrication is of vital importance in Diesel engine operation, so installed a Goulds Hydroil Centrifugal Oil Purifier.

Dirty lubricating oil is passed through a Goulds Hydroil and, after purification, returned to the engine's clean oil reservoirs. This is another instance where Diese operators have learned the importance of cleaning oil to reduce engine wear.

Other plants can also obtain these same advantages from a Goulds Hydroil. Our Engineers are always available for consultation on your oil purification problems. Write today for complete information.

Another Goulds aid to Diesel operating economy—the new Goulds Exhaust Gas Heater. Without any operating cost, it preheats oil for centrifuging. Cold oils and highly viscous oils are quickly and economically heated for efficient centrifuging by utilizing B.T.U.'s otherwise wasted. It does away with the need for current consuming electric heaters, requires little attention, controls the temperature automatically or manually. Let us send you Bulletin No. 510 on the Goulds Exhaust Gas Heater.

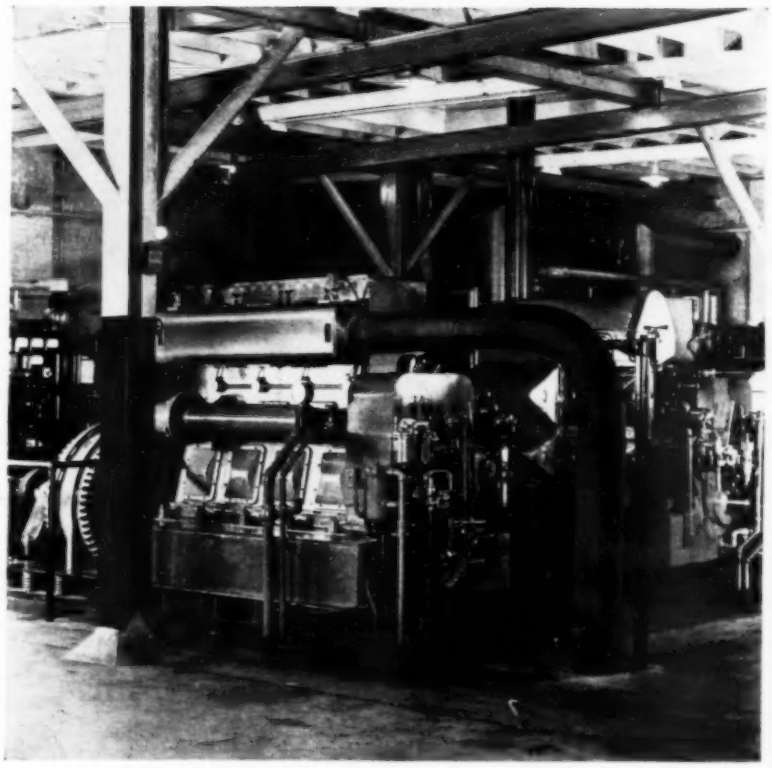
GOULDS PUMPS Inc.

SENECA FALLS N. Y.

ATLANTA, BOSTON, CHICAGO, HOUSTON, NEW YORK, PHILADELPHIA, PITTSBURGH, TULSA, Representatives in all Principal Cities

3356

Calumet Refining Co. saves $650.00 per month with a proving ground for lubricants - - - - -



Two 150 H. P. Superior Diesel engines in the plant of The Calumet Refining Company, Burnham, Illinois.

"Proving grounds" and laboratories usually save money for both manufacturer and consumer and this installation is no exception.

First of all, these Superior Diesels furnish power at a monthly saving of $650 to the BURNHAM REFINERY OF THE CALUMET REFINING CO., REFINERS OF A LINE OF DISTINCTIVE AUTOMOBILE AND DIESEL LUBRICATING OILS, manufactured exclusively under the Schulze high vacuum process. These oils are marketed under different brands but are identified by their emblem indicating their "patented heart cut" nature.

The engines also serve as part of the laboratory equipment in a constant program of product test and development for the benefit of the consumers of the products of this refinery.

Of great importance to a manufacturer of lubricants is the opportunity to develop his product for the exacting needs of Diesel engines, under the constant observation and test possible with this typical pair of modern, heavy duty engines.

After a run of 7027 hours from October 1936 to October 1937, engine No. 10277, which was lubricated with "BURNHAM" S. A. E. 30 lubricating oil, was completely dismantled and inspected.

In spite of nearly constant operation and occasional high overloads, the wearing parts of the engine were found in condition nearly equal to new, with only average liner wear of .0015 inch, with rings free and clean, valves in good condition, bearings tight and free from any corrosion, and heads and pistons with only a very light deposit of fluffy carbon which could be wiped off with the fingers. Further, using this oil and "BURNHAM" fuel, lube oil consumption was less than half of Engine Manufacturer's guarantee and fuel consumption was also lower than guarantee.

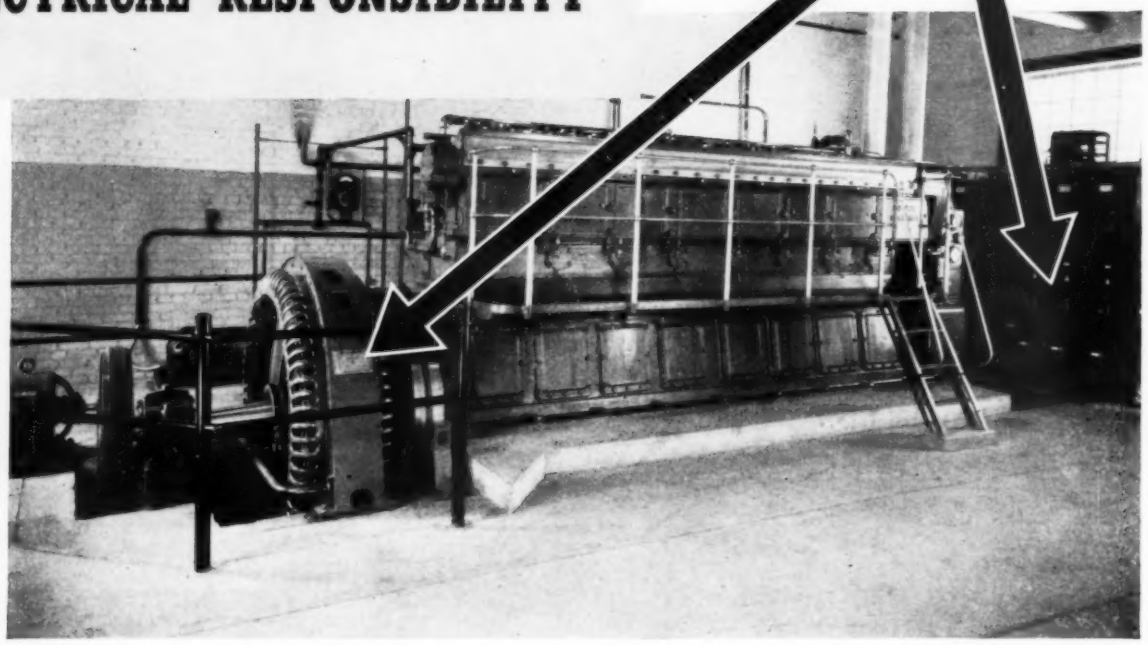
The results are eloquent of the reliability and economy of good Diesel engines when their performance is safeguarded by the use of high grade lubricating oils and fuels which have been developed for a specific purpose under actual operating conditions.

THE NATIONAL SUPPLY COMPANY . . . SUPERIOR ENGINE DIVISION

FACTORIES: Springfield, Ohio; Philadelphia, Pa. · SALES OFFICES: Springfield, Ohio; Philadelphia, Pa.; New York, N. Y.; Los Angeles, Calif.; Houston, Texas.

UNDIVIDED
ELECTRICAL RESPONSIBILITY

Westinghouse



YOU'LL get better results from your Diesel-Electric plant if you place the responsibility for its perfect operation on one, dependable manufacturer. Make it Westinghouse throughout; generator, switching apparatus, voltage regulators, exciters, motors and control for auxiliary equipment.

Westinghouse A.C. Generators are matched to the Diesel engines driving them. Similarly, the other equipment should be designed to operate as matched units, to assure long life and high efficiency. Westinghouse has the engineering and manufacturing facilities to assume such complete responsibility.

Nationwide service facilities are concentrated in 37 Westinghouse service shops. No matter what your need, factory-trained experts are always available to give you prompt and efficient service. This is another advantage of undivided responsibility on electrical equipment.

The booklet, "A.C. Generators for Diesel Engine Drive," gives detailed data on Westinghouse Generators and auxiliary equipment. Write for a free copy.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, EAST PITTSBURGH, PENNA.

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WESTINGHOUSE ELECTRIC

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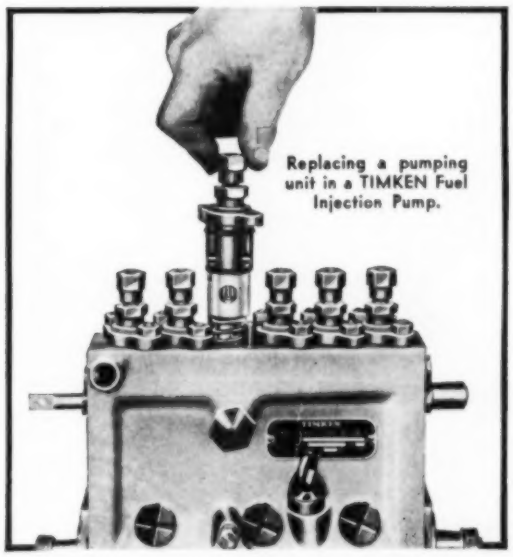
Replacing a pumping unit in a TIMKEN Fuel Injection Pump.

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Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

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The GM Diesel makes the great economies of Diesel-Electric Drive more adaptable to more types of vessels than ever before

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The GM Diesel's new flexibility puts the lower operating costs and greater safety of Diesel-Electric Drives within the ready reach of practically all ships up to 9,000 deadweight tons!

Designed on the GM 2-cycle principle, this new-type Diesel is more compact—actually packs more power per cubic foot than marine Diesels of the past.

And since each of its cylinders operates independently, the required horsepower may be obtained with equal efficiency by installing a number of small units in available waste spaces—or by consolidating it in one large unit—whichever is most desirable for your particular vessel.

Thus thousands of marine operators whose ships once seemed unsuited to a Diesel-Electric Drive can today enjoy its fuel savings, elimination of stand-by losses, and the facile maneuverability provided by its instantaneous pilot-house control.

That is the significance of this new adaptability of the GM Diesel. Look in the panel below and you will see how wide is its range of uses.

Of equal interest, too, should be the news that under the General Motors all-inclusive policy of manufacture, installation and service, you are assured of a minimum "time out" for servicing and repairs.

FOR ALL MARINE USES—GM DIESELS

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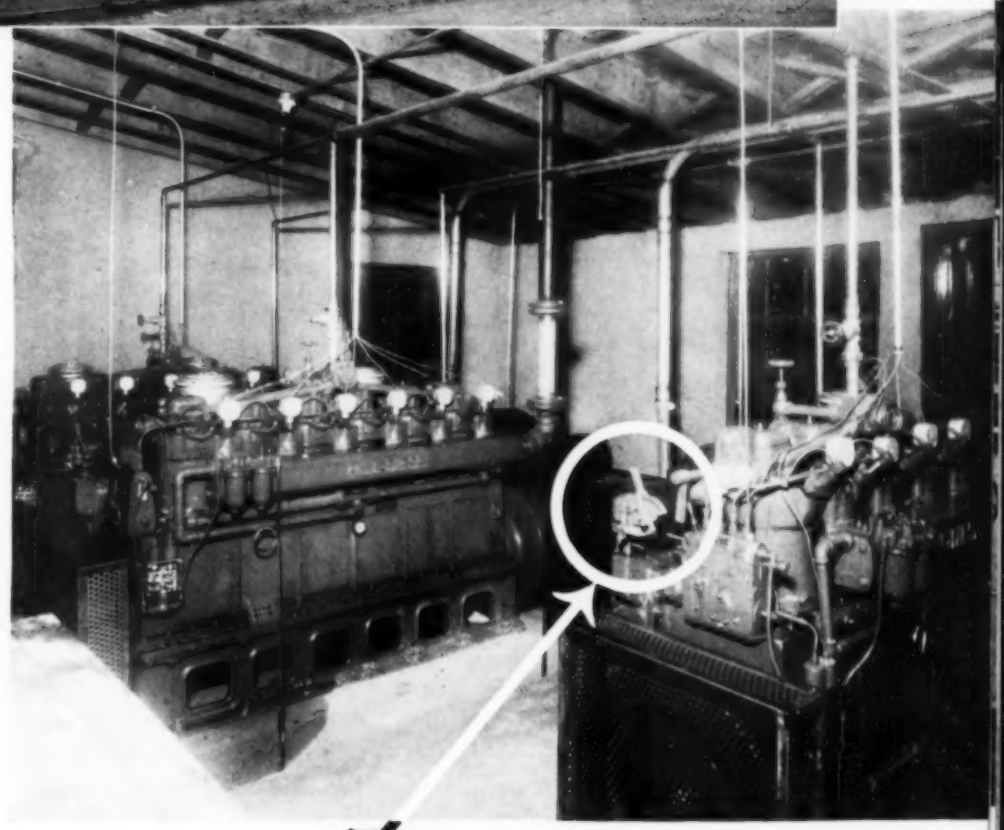
DIESEL ENGINE DIVISION • Cleveland, Ohio

PIERCE GOVERNORS



Pierce Governors are installed on all Three Hill Diesel Engines in the Big Bear Market Diesel plant.

HILL DIESELS...

The three Hill Diesel Engines installed in the Big Bear Market, Paterson, N. J., are all equipped with Pierce Governors. See details of this highly successful installation on pages 49, 50 and 51 of this issue.

Our congratulations to the Hill Diesel Engine Company on this outstanding installation and on their selection of such a high quality governor for the rigid service to which these three engines are put.

Just another example of the general trend amongst Diesel engine builders to standardize on Pierce Governors. Pierce Governors are designed to meet the particular requirements of each manufacturer of Diesel engines. Being of the centrifugal (flyball) type, they respond instantly to each change in engine load and maintain a uniform speed.

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PIERCE GOVERNORS
STANDARD SINCE 1913

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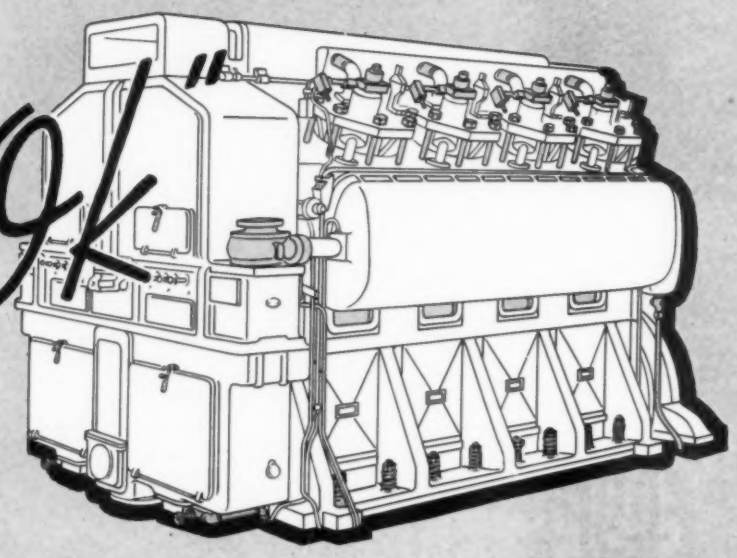
WHEN THE ENGINEER SAYS...

"It's OK"



ALCOA The Aluminum used in your Diesel engine got a lot of attention before that engine was delivered to you to place in service. Consider first what happened in the manufacturer's plant.

The engine designers analyzed the advantages to be obtained by using Aluminum. Production men determined what fabricating methods should be followed for best results. The finished parts were given every known test to prove their soundness. The completed engine was operated on the test stand hour after hour, day after day, delivering full load; economy and reliability of the engine were convincingly checked.

Equally important was our study made before the Aluminum parts were delivered to the manufacturer. The importance of these factors was determined; the light weight of Aluminum; its superior heat conductivity; resistance to corrosion; strength and ability to stand up in the grueling Diesel service. For each use, the Alloy of Alcoa Aluminum best meeting the requirements was recommended.

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Light and power plants all over America are turning to Macmillan RING-FREE Motor Oil for lubricating their diesel engines. The reason? Because, wherever diesels are used ... in stationary or motive equipment ... engineers and master mechanics praise RING-FREE as the answer to their lubricating problems. RING-FREE increases the power delivered and lengthens the time between overhauls, because it reduces friction wear, operating temperatures and removes carbon formed by fuel or other oils. And, furthermore, RING-FREE does this grand lubricating job equally well in all types of diesel, gasoline or natural gas engines.

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5. REMOVES HARD CARBON
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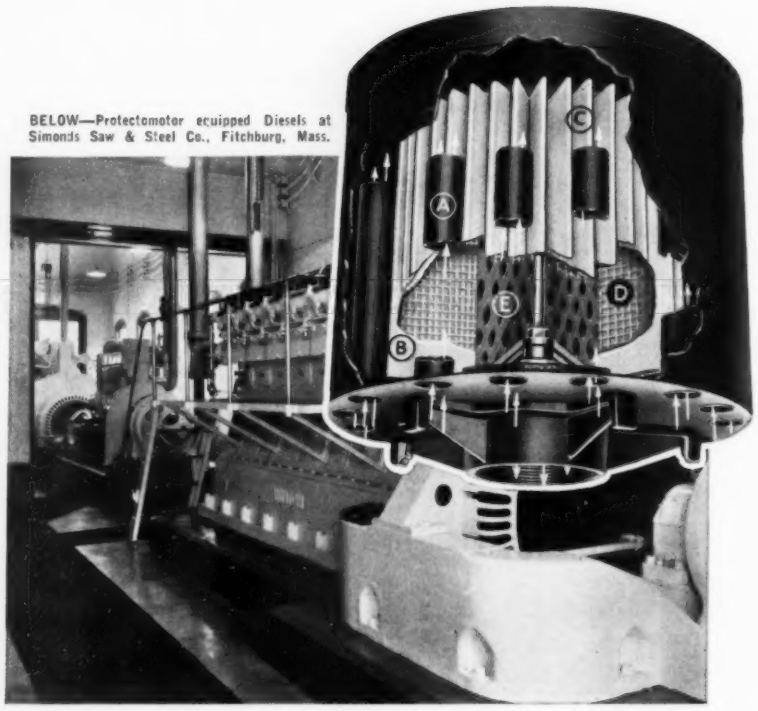

BELOW—Protectomotor equipped Diesels at Simonds Saw & Steel Co., Fitchburg, Mass.

SILENCES *noisy Diesels... and* FILTERS *air to Diesel intakes*

COSTS LITTLE MORE THAN A SILENCER OR FILTER ALONE . . . Why buy an air filter and then have to purchase a silencer later at extra cost? Get a Protectomotor Model DS the *first* time—it is not only the finest air filter ever made but an effective silencer of intake noise as well on both Diesel engines and compressors. New, exclusive construction—the only combined silencer-filter on the market. Complete range of sizes. Easily installed.

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B. Dry Feltex Filtering Medium.
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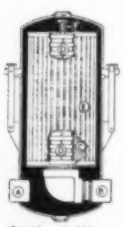
Sixteen years of service in thousands of applications have proven the superiority of the patented Radial Fin Construction used in all circular Protectomotor engine intake and lubricating oil filters. This exclusive construction possesses two great advantages—first, it has no broad, flat surfaces to vibrate in pulsating intake service; second, it permits the largest possible area of filtering surface to occupy the smallest possible space. This means unrestricted air flow and long, service-free operation.

MODEL CPHL



Sectional View MODEL CPHL

PROTECTOMOTOR LUBRICATING OIL FILTERS

Models CPL and CPHL. Efficient, easily installed and economical filters for Diesel and other stationary internal combustion engine lubricating systems. Horizontal (CPHL) and vertical (CPL) models—(horizontal shown). Inserts quickly removed and easily cleanable. One insert good for many months of heavy duty operation; then may be replaced at low cost. Anyone can open filter for cleaning or inspection in 5 minutes by means of quick-acting swing clamps.

(A) Inlet.
(B) Outlet.
(C) Wire mesh frame.
(D) Reinforced core.
(E) Radial Fin Construction.
(F) Spring for retaining plate.

"Air Filter Headquarters"

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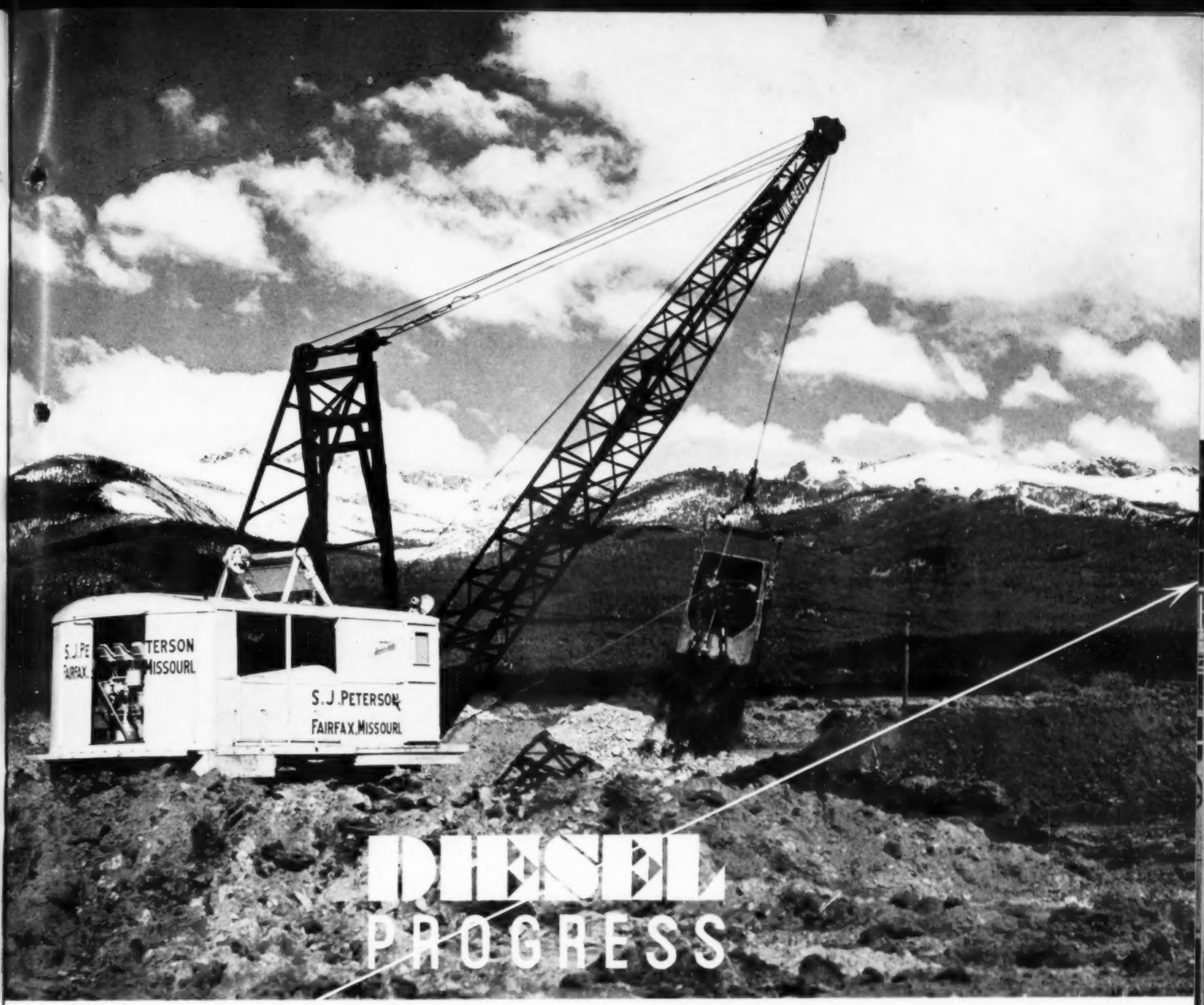

REX W. WADMAN
Editor and Publisher

FRONT COVER ILLUSTRATION—Caterpillar Diesel RD 7 equipped with LeTourneau Bulldozer landscaping in front of the main entrance for the Golden Gate International Exposition. Tractor consumes 3¾ gals. 5½c. fuel per hour.

TABLE OF CONTENTS—Caterpillar Diesel engine in Link-Belt dragline (2½ yd. buck and 60 ft. boom) at work near Leadville, Colorado. Working 20 hours a day on 6 gals. 11c. fuel per hour. Moving 200 yds. material per hour.

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B. J. VON BONGART
Technical Editor

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PHOENIX, ARIZONA

Diesel Standby for the Water Power System of the Salt River Valley Water Users' Association

By H. J. LAWSON,

General Superintendent and Chief Engineer, Salt River Valley Water Users' Association

THE Salt River Project of Arizona is one of the earliest reclamation projects undertaken by the Federal Government. Part of the Salt River Valley was in a high state of cultivation and civilization in prehistoric times, probably about the 10th to 12th centuries. The white man moved into the valley during the late 1860's and commenced to build canals and irrigate the fertile land. Due to the erratic stream flow agriculture was on a precarious basis until the Federal Government built the Roosevelt Dam on Salt River to impound flood waters and store same for use when the natural flow of the river was less than irrigation requirements. Along with the development of the irrigation works, power has been developed to the extent of approximately 115,000 hp. in hydro-electric plants, utilizing water as it is released for irrigation.

The Salt River Valley Water Users' Association, composed of the landowners on the Salt River Project, operates the works built by the government and the Association has, with its own financing, built most of the power system as it exists today. There are four dams on Salt River with a power plant at each dam, with heads varying up to 272 feet. There are also four water power plants on the canal system, utilizing drops in the canals, the heads varying from 19 feet to 42 feet. All the irrigation water obtained from Salt River passes through four power plants and some of it passes through six plants before reaching the irrigated lands.

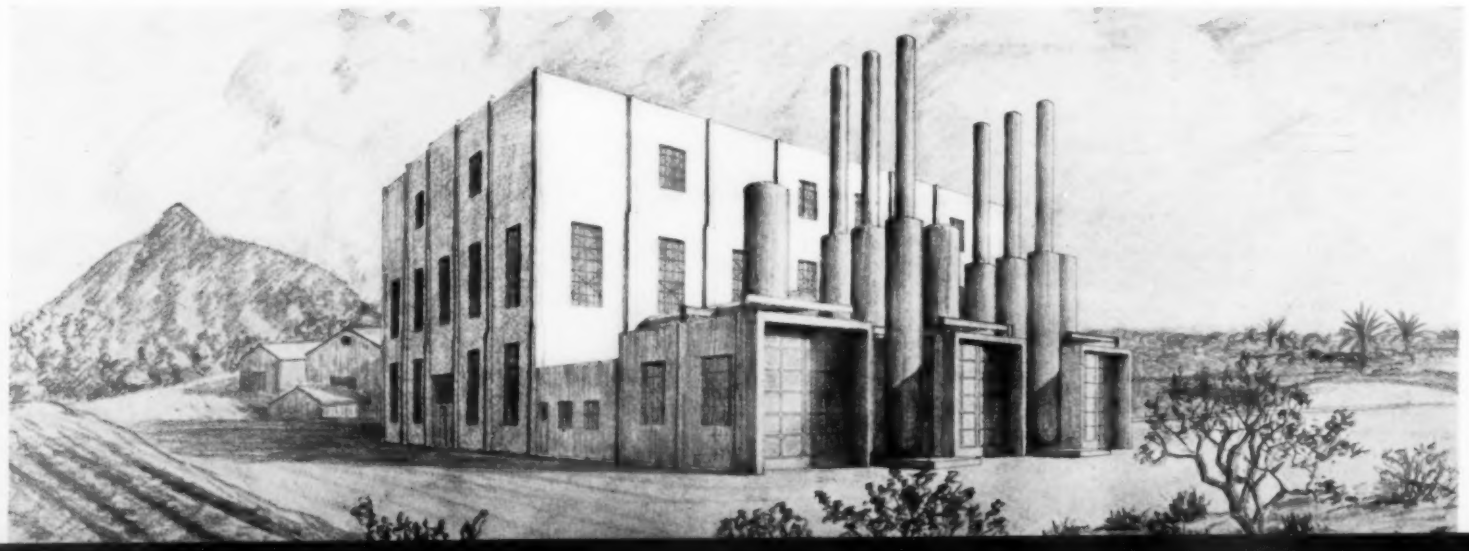
On Salt River the two lower dams create regulating reservoirs which fluctuate from practically empty to full each year thereby creating storage for water run through the two upper, higher head plants and providing power generation at seasons when the irrigation demand for water is at a minimum.

The total storage capacity on Salt River is 1,900,200 acre feet of which 1,522,000 acre feet are in the Roosevelt Reservoir at the upper end of the developed part of the river. The annual use of water for irrigation on the Salt River Project from Salt River averages about 700,000 acre feet. This amount of water passes each dam and power plant through a total drop of from 600 to 750 feet, varying with the amount of water in storage and the seasonal operation of the reservoirs.

A ready market for power exists in the region. Power is supplied to towns and cities in the area, for mining purposes, for irrigation pumping, manufacturing, cotton ginning and rural domestic use. To supply this market requires firm power and the water power system, with a variable amount of power available, must have standby capacity available for emergencies and for carrying peak loads. For the past nine years this standby and peak load capacity have been obtained by contract with the local power company in Phoenix. When this contract was about to expire the Salt River Valley Water Users' Association decided to build their own standby plant.

Having had years of experience with steam standby, investigations were made regarding

Wash drawing illustrating general appearance of the plant after the second engine is installed.



General view of the plant at Tempe, Arizona, showing settling tank in foreground, fuel oil storage tank to the left, Fluor cooling tower in rear, lube oil storage tank in center, and main building of the plant to the right rear.

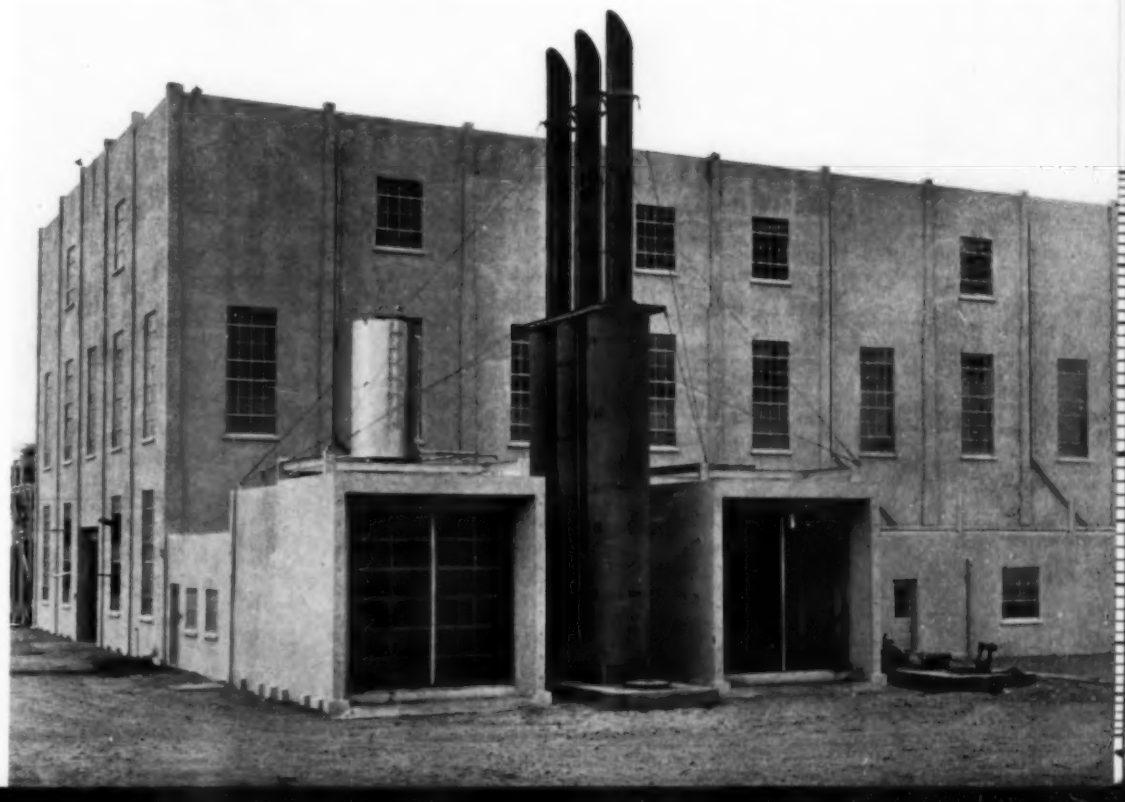
NA DIESEL PLANT

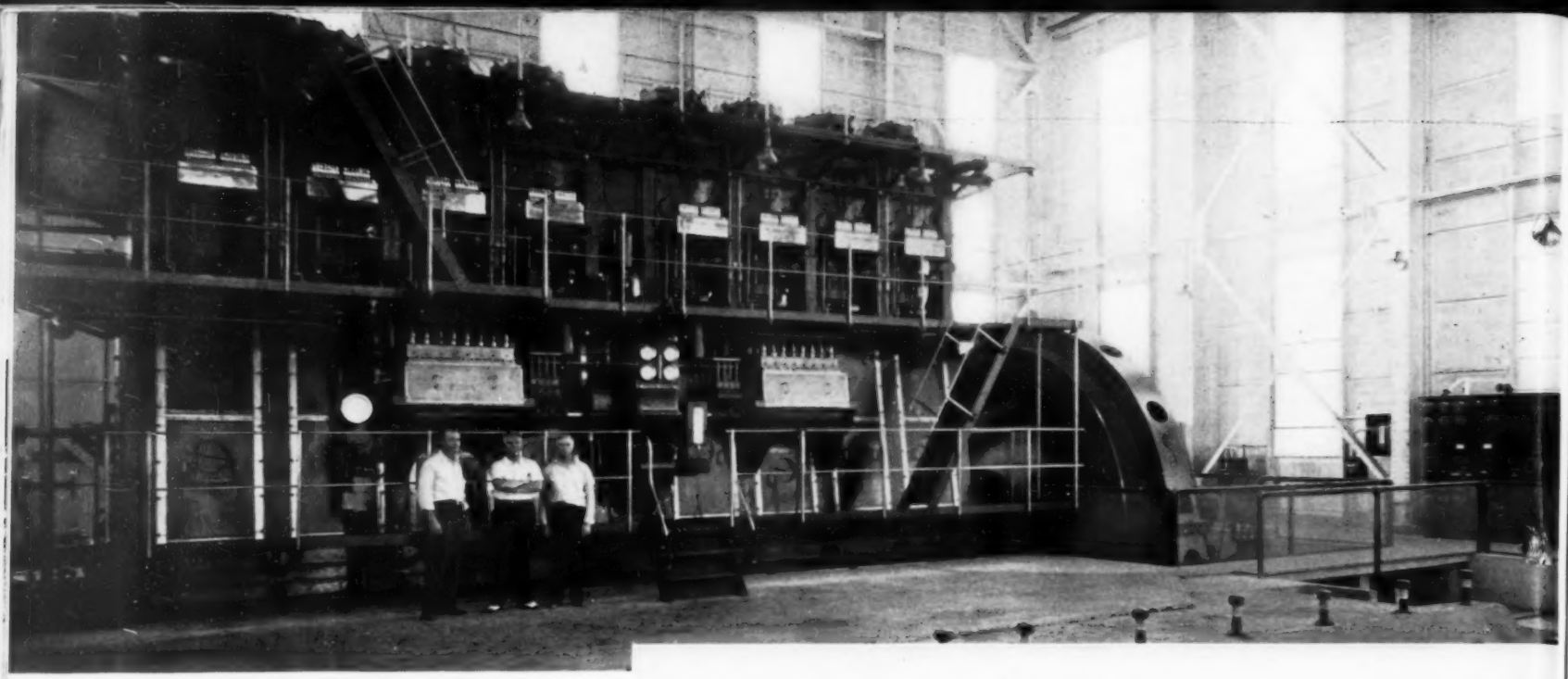
Diesel engine plants for this purpose, and the use of engines was decided upon. As compared to steam for standby and peak load service the Diesel plant, under the conditions existing on this system, is the better. Operation has begun and the expected performance as to its adaptation for this particular job has fully materialized. Operation of the steam plant has been necessary for carrying peak loads a large part of the time. Much of that time required no steam for eight to ten hours a day, but the plant could not be started up and stopped every day, due to the excessive cost thereof in fuel and repairs. The minimum load, that the turbine could operate under satisfactorily, was 4,500 kw., the turbine having a capacity of 18,000 kw. Thus for thousands of hours fuel was being used to generate power at low economy at a time when water was being bypassed around the power plants, it being necessary to release sufficient water for irrigation requirements. Furthermore the steam plant was given a base load with the regulation being taken by the water power plants. The steam plant operators insisted upon this condition as the economy of the steam turbine and the operation of boilers would have been very adversely affected by regulating power swings of 2,000 to 5,000 kw. which were constantly coming on the system, mostly from large mine hoists and other large intermittently loaded equipment. Furthermore to operate this particular steam plant of one unit of 18,000 kw. capacity required an operating force in excess of twenty men. On cold standby six hours are required to put the steam plant in operation; on hot standby, with steam up but the turbine at rest, one to one and one-half hours are required.

One 5,000 kw. Diesel engine generating unit has been installed and in operation for about a month. The unit is handling the load variations of the system perfectly with load swings up to 4,000 kw. These large load swings are not instantaneous, but cover an appreciable length of time of 15 to 30 seconds. With the Diesel unit regulating the speed of the system, the water power plants are given base loads at maximum output resulting in more kilowatt hour output with a consequent reduction in kilowatt hour generated by fuel. The increased output of water power costs nothing as the irrigation demand during the period from April to October exceeds the capacity of the water wheels to pass water and water is bypassed in varying amounts practically continuously during those months. With the growth of load it may soon become economical to install more capacity in some of the water plants as peak load units, even though their use will be limited to six months of the year. The system load peaks in the Summer-time due to a large irrigation pumping load of some 30,000 kw. which synchronizes with the irrigation demand on the reservoirs. The daily load factor of the system during the Summer months is high and will average close to 90 per cent.

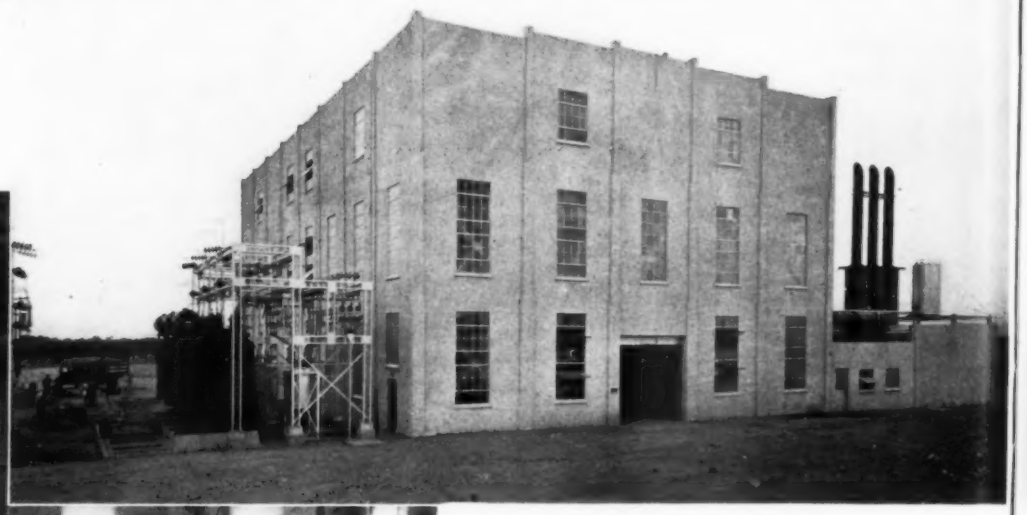
The economy of the Diesel engine is such that variations of load do not affect same to any considerable amount if the load does not go below one-half capacity. With the second duplicate unit in, due for completion in September of this year, the two engines can easily

Air-Maze air filter installation on intake side of blower room with fuel oil day tank above. Adjoining are the three large Maxim silencers.

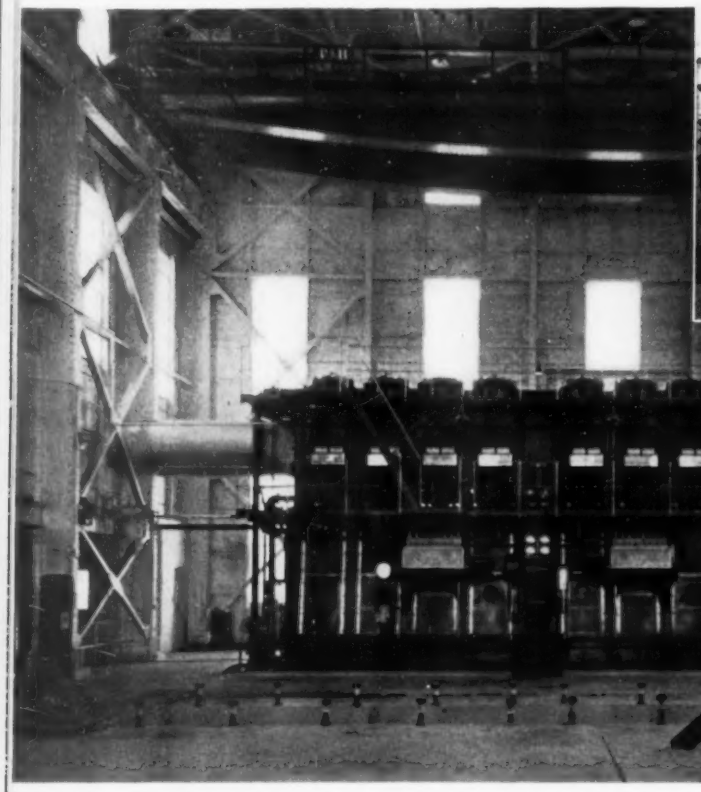




The three men in front of 7,000 hp. Hamilton-M.A.N. engine give an idea of the size of this big unit. Cecil Hagan on the left was the chief erector in charge of erection activities, in the center is Rex W. Wadman, editor of DIESEL PROGRESS, *and to the right is Thomas M. McComb, superintendent of the plant, previously superintendent of the Vernon, California, Municipal Diesel Plant.*



The front of the building showing the Westinghouse transformers and Kelman circuit breakers.



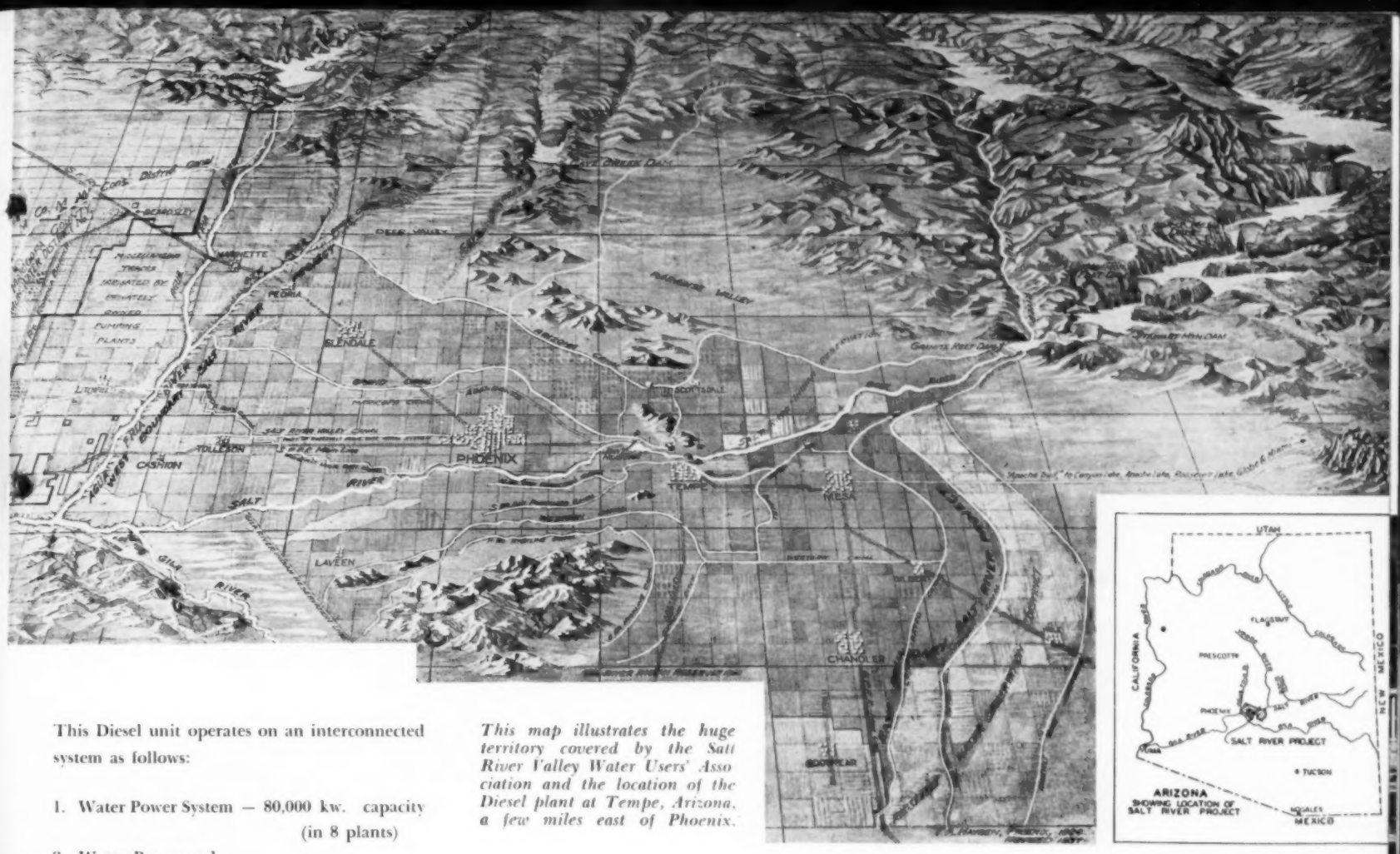
General view of the engine room showing foundation bolts and foundation for the second 7,000 hp. Hamilton-M.A.N. engine which is due for delivery this September.

take care of all load changes without light load on either unit.

So far, and it is expected the same conditions will continue for some time, the Diesel unit operates only on the peak load which, for this system during the Summer season of heavy load, occurs from 9 A.M. to 4 P.M. The plant is shut down in the late afternoon, locked up and left with only a watchman until 8 A.M. next morning. Within fifteen minutes after the operators arrive at the plant the unit is carrying load. It is possible to bring the unit from stand-still to full load in less than five minutes. The operating force required for one 5,000 kwh. Diesel unit is 5 men, and for two such units such force will not exceed 8 men when the plant is operating 24 hours daily.

The outstanding advantages of the Diesel plant for the conditions of this power system are in its ability to operate on the variable load without undue loss of economy, the possibility of quick starting and loading of the units, and the low cost of idle standby.

There are no Diesel engines of larger capacity in the United States. There are five other duplicate units in Vernon, California, which operated on the load of the City of Vernon for about five years.



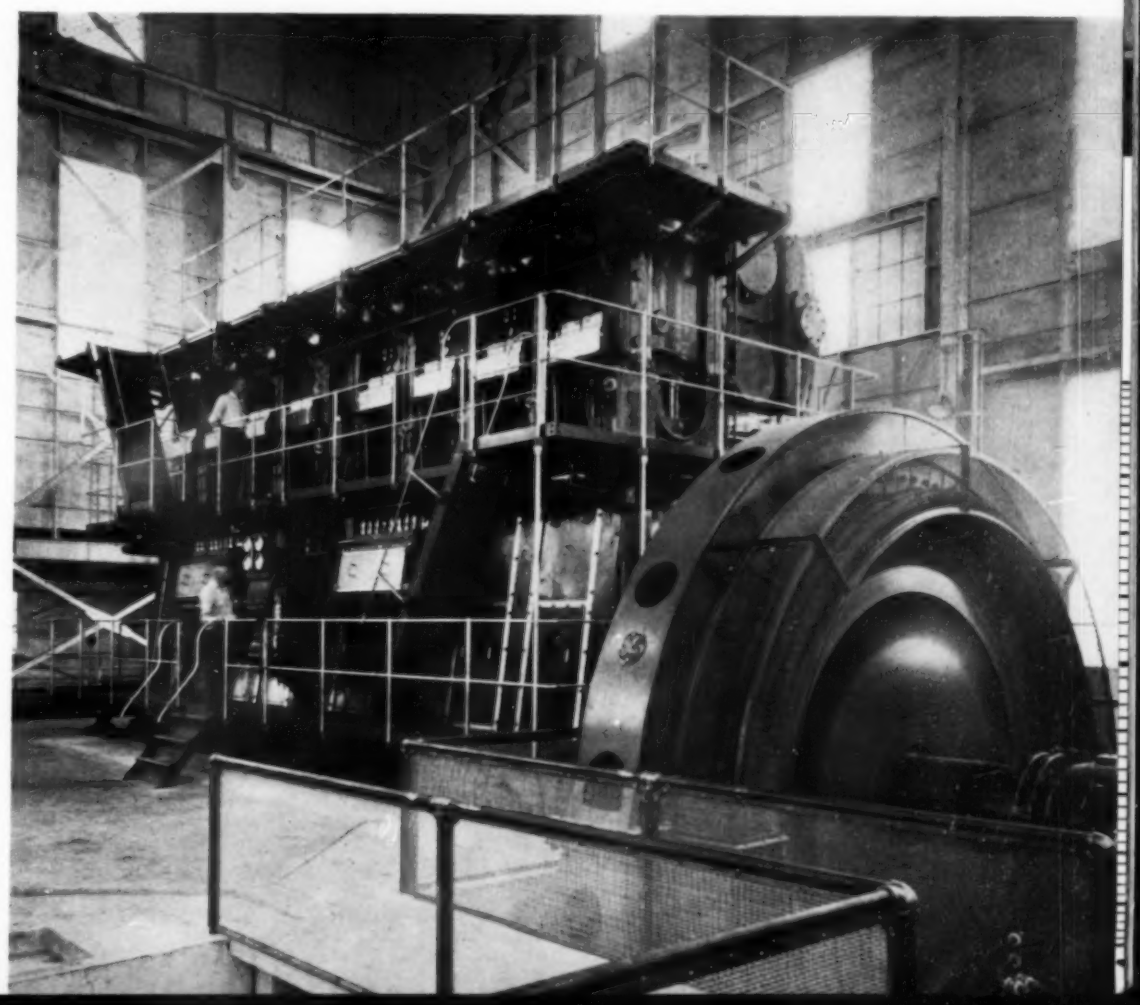
This map illustrates the huge territory covered by the Salt River Valley Water Users' Association and the location of the Diesel plant at Tempe, Arizona, a few miles east of Phoenix.

This Diesel unit operates on an interconnected system as follows:

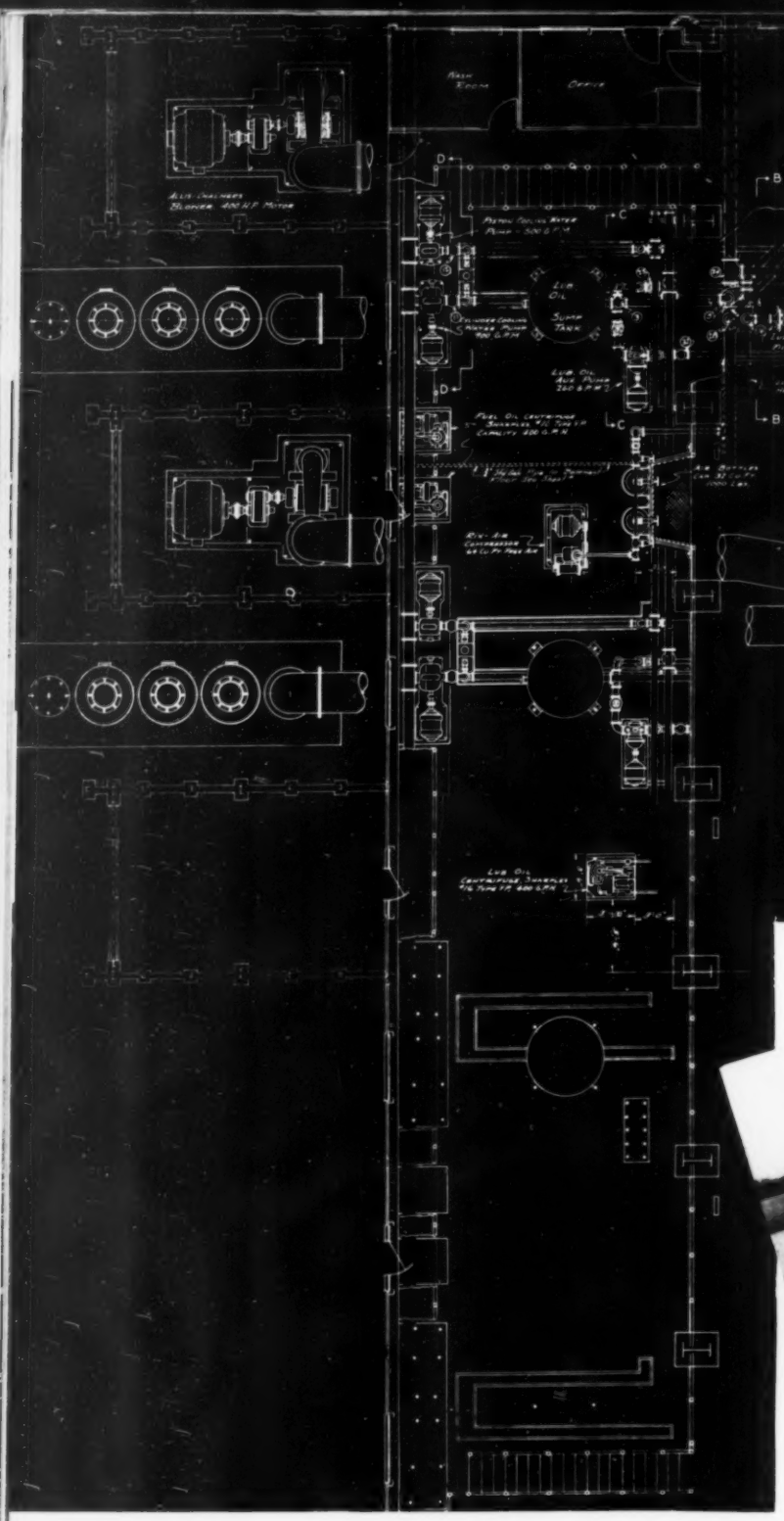
1. Water Power System — 80,000 kw. capacity (in 8 plants)
2. Water Power and Steam — 12,000 kw. capacity
3. Steam Plant — 30,000 kw. capacity
4. Steam Plant — 25,000 kwh. capacity
5. Steam Plant — 7,500 kwh. capacity
6. Steam Plant — 7,500 kwh. capacity

The Diesel plant, water power system No. 1, and the steam plants Nos. 4 and 6 are all 25 cycles, the other plants are 60 cycles. The two frequencies are interconnected through large frequency changer units. All plants operate in parallel with perfect satisfaction. The plants are widely distributed, the distance between the most remote being about 200 miles. At present steam plant No. 4, owned by a large copper mine, is shut down, the present Diesel unit taking the load swings from all the interconnected systems. Steam plant No. 3 is at present operating with only 1 unit of 18,000 kw. capacity, operating on base loads which are varied two or three times a day in amount, but in fairly large blocks. A base load given to this steam plant usually remains unchanged for many consecutive hours.

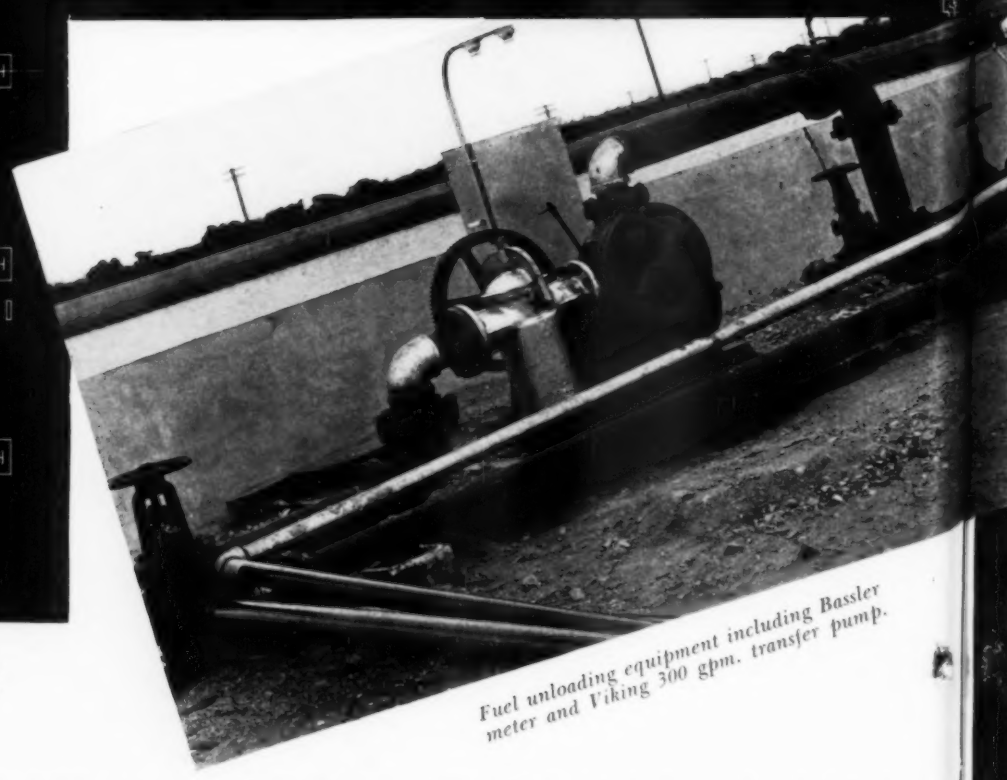
The engine operates with practically no outside noise with the exception that the blower can be heard several hundred feet from the plant. There is no noticeable noise from the engine exhaust.



This view illustrates the 6,250 kva. General Electric 25-cycle 6,600 volt generator attached to the 7,000 hp. 24" x 36" 8-cylinder, double acting, solid injection Hamilton-M.A.N. engine in the Tempe, Arizona plant of the Salt River Valley Water Users' Association. Cecil Hagan, chief erector, on upper platform and Tom McComb, superintendent of the plant, on the lower platform.



Drawing showing how the Tempe, Arizona, Diesel plant will look after the second engine is installed. The location of all accessory equipment is well marked.



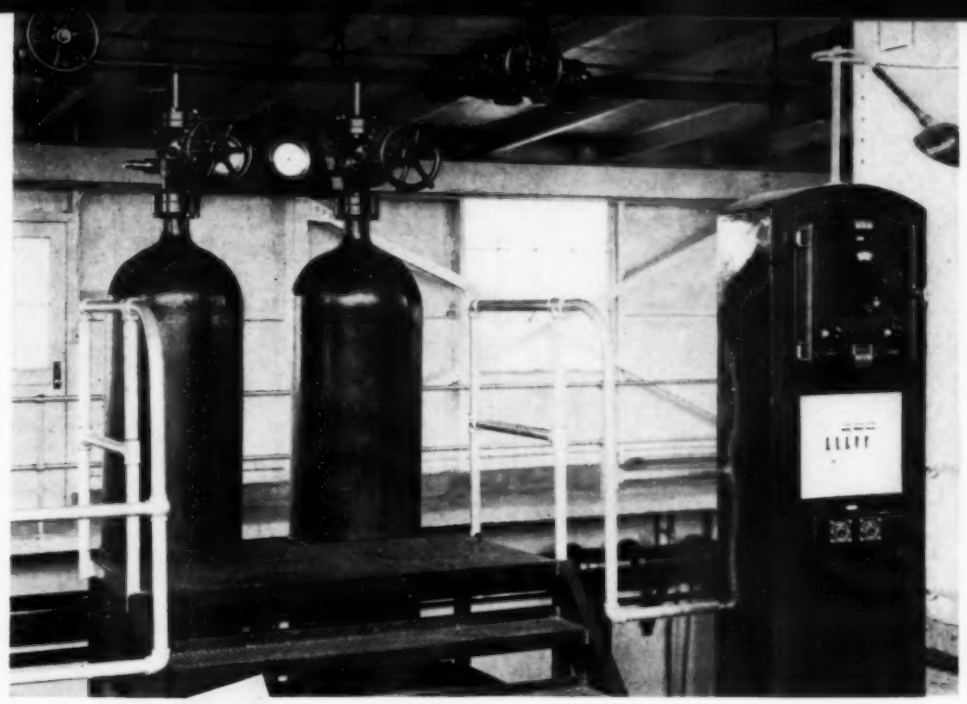
Fuel unloading equipment including Bassler meter and Viking 300 gpm. transfer pump.

The engine will successfully use fuel of as low a gravity as 18° or 19° Baume. However, it is expected that fuels of somewhat higher gravity will be used as such fuels are obtainable at reasonable cost and the wear of cylinder liners and piston rings will be less with higher grades of fuel especially if the carbon content is kept as low as practical.

The cost of the plant complete with two units, with the building capable of housing 3 units, will be about $100.00 per kw. of capacity. With fuel oil at present prices it is expected that production cost will be about 4 mills per kwh., depending on the plant load factor which will be variable.

On official test the unit developed 12.93 kwh. net per gallon of fuel oil or 543.28 kwh. per barrel at full load.

The investigations leading to the selection of Diesel engines for this standby plant were made by the writer in conjunction with Mr. Lin B. Orme, president of the Salt River Valley Water Users' Association. The plant was designed by the engineering forces of the Association with the assistance of Mr. H. M. Petersen, the western representative of the General Machinery Corporation, the engine builder.



Leeds & Northrup recording pyrometer and switches for controlling blower and service pumps. Air supply tanks to the left.

THE DIESEL POWER PLANT

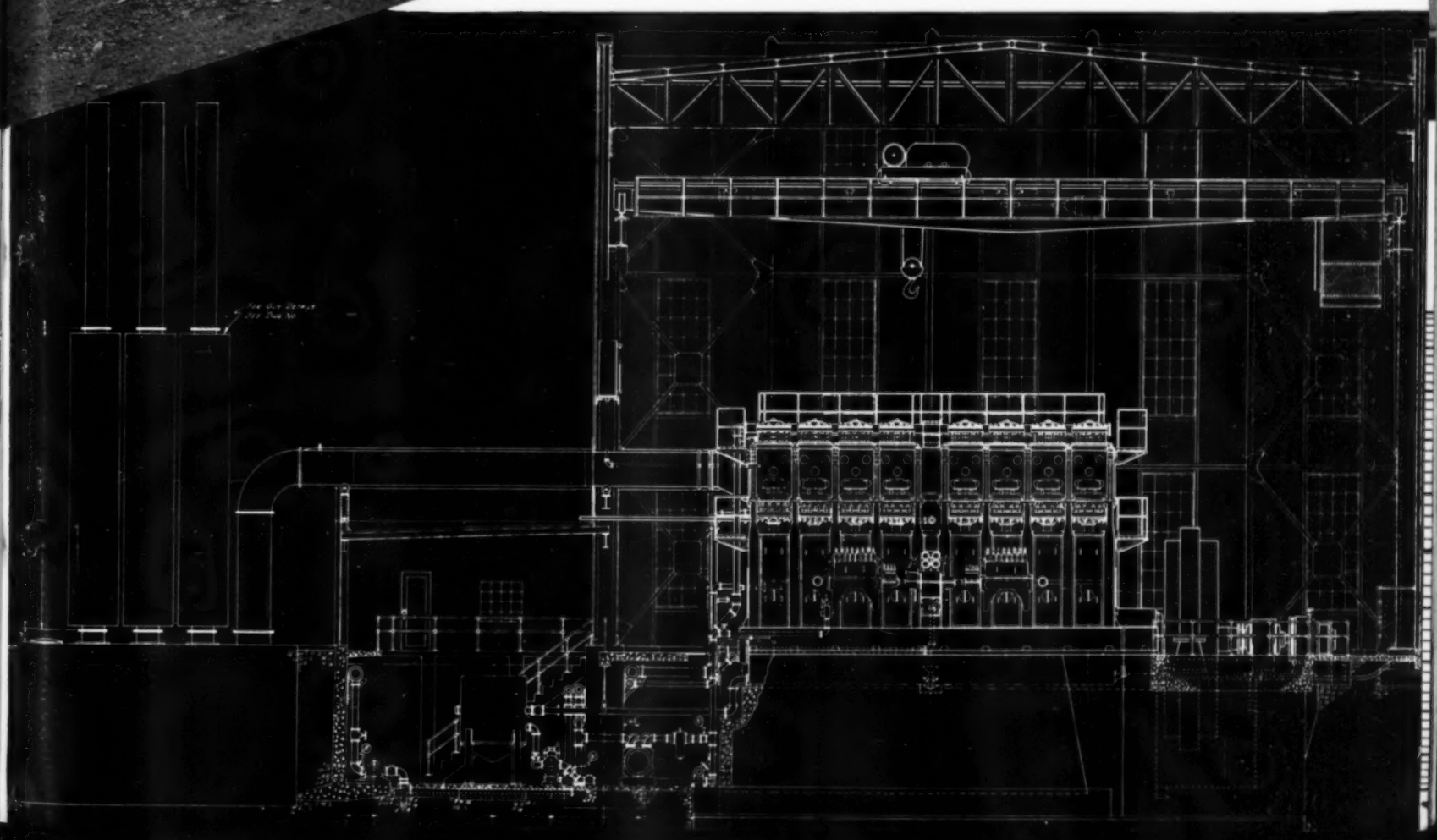
By REX W. WADMAN

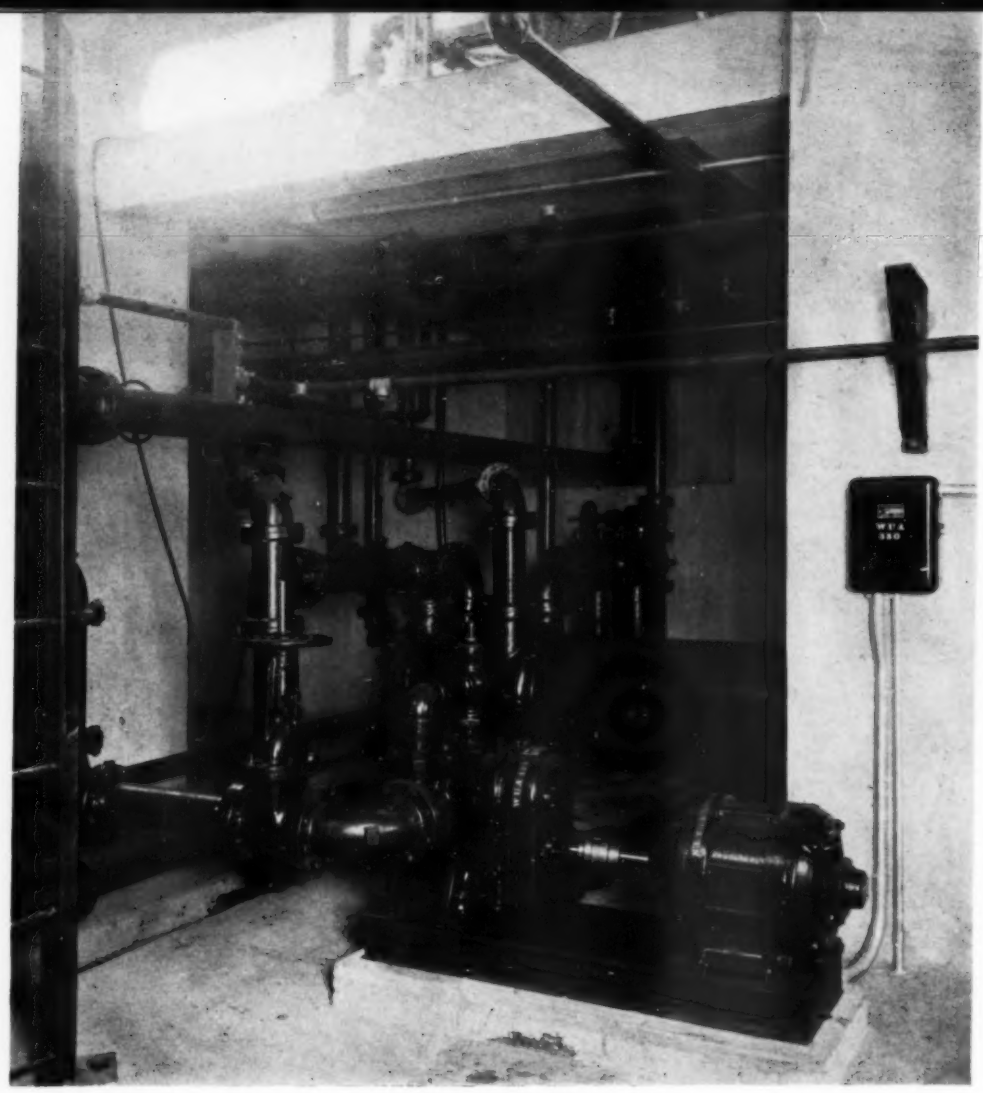
MR. LAWSON has very capably outlined the operations of the Salt River Project and also their reason for selecting a Diesel standby generating plant rather than a steam. I now take up the burden of the story and briefly describe the new Diesel power plant itself.

The building is steel frame construction with cement gunite walls and roof. The building as now erected is long enough to hold four units of the same size as the one now installed, although the crane runway is not at present long enough to handle more than three engines. It will be noticed, however, that the end of the building furthest from the present engine is sealed with ordinary galvanized iron which readily permits extension of the building to take in up to and including eight engines of this same size. At the present time, however, one engine is installed and the foundation for a second engine has been placed and this second 7,000 hp. unit is now under construction and due for delivery in September of this year. Every indication points to a steady growth of this Diesel plant inasmuch as it has already, in its short period of existence, proved itself ideal for the purposes for which it was designed. The whole layout of the plant is simple, effective, and efficient. No frills, no unnecessary equipment, but every needed accessory has been installed to make this plant easy and economical to operate.

The first engine installed is a 7,000 hp. Hamilton-M. A. N. engine, 8-cylinder, double acting, solid injection, bore 24 in., stroke 36 in., manufactured by the Hooven, Owens, Rentschler Division of General Machinery Corporation, Hamilton, Ohio. This engine is direct-connected to 6,250 kva. General Electric 6,600 v., 25-cycle generator, with direct-connected exciter

General view of plant complementing figure 7. notice exhaust arrangement whereby the exhaust is led from engine to large cement pit and thence out through three Maxim silencers.





Lubricating oil handling equipment consisting of storage tank to extreme left, Northern transfer pump, Braun heat exchanger, and duplex Elliott strainers.

and pilot exciter with automatic voltage regulation. Immediately outside of the build are located the 6,250 kva. Westinghouse transformers, 6,600 to 45,000 volts, self-cooled, and adjoining them are the 6,600 to 50,000 volt Kelman oil circuit breakers.

A 32,000 cu. ft. Allis-Chalmers scavenging blower driven by 400 hp. induction motor is installed in a separate room as indicated in figure 7. The cooling equipment consists of a Fluor aerator cooling tower, total capacity 2,800 gpm. from 120° F. to 90° F. with a 77° wet bulb and a 5-mile wind, in addition to which there is a large settling pond as shown in figure 1.

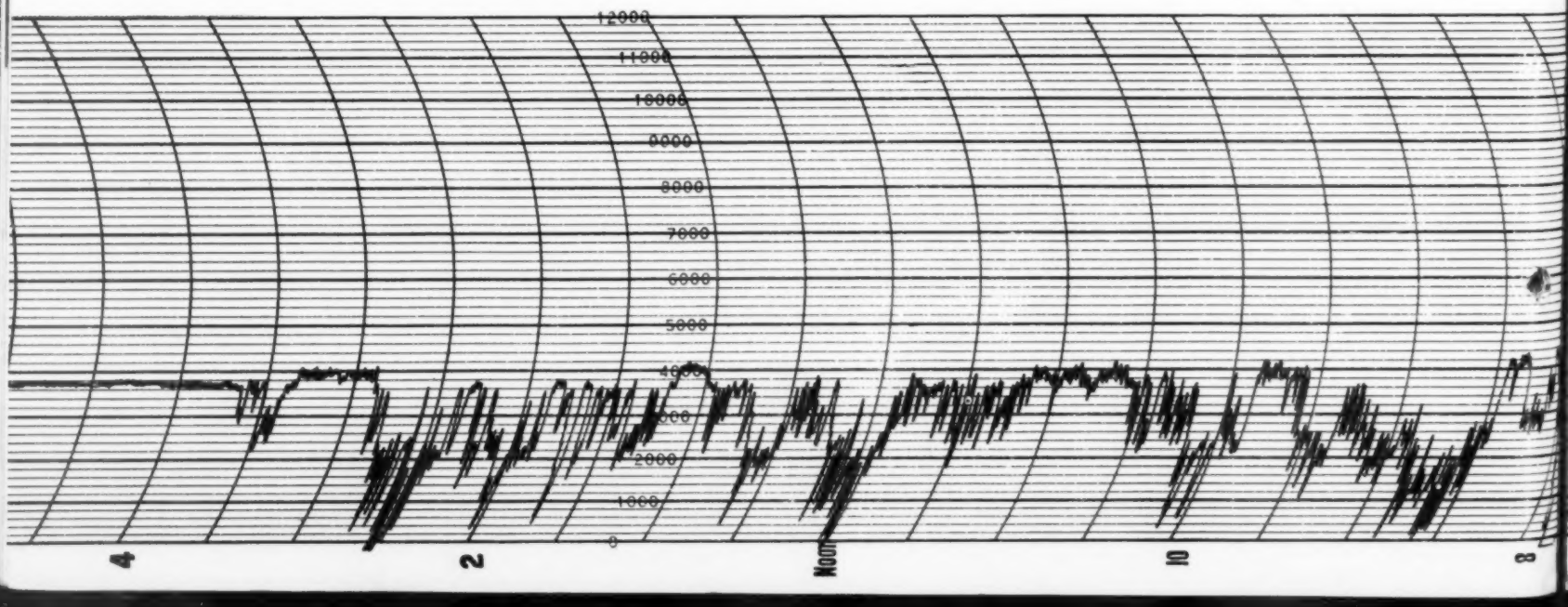
In figure 1 may be seen the 420,000 gal. capacity fuel tank, the Fluor cooling tower, and the 12,000 gal. capacity lubricating oil storage tank, and then the rear view of the power plant itself showing the corrugated iron temporary rear wall which permits the extension of the building to take in additional engines. In figure 2 a close-up of the air filter installation is shown consisting of 24 Air-Maze unit type air filters. Immediately back of this battery of air filters is the Allis-Chalmers scavenging blower and on top of this small room is the fuel day tank. To the right of the blower room will be seen the three large Maxim silencers mounted on top of a cement chamber into which the exhaust is led from the engine. See figure 10 for details.

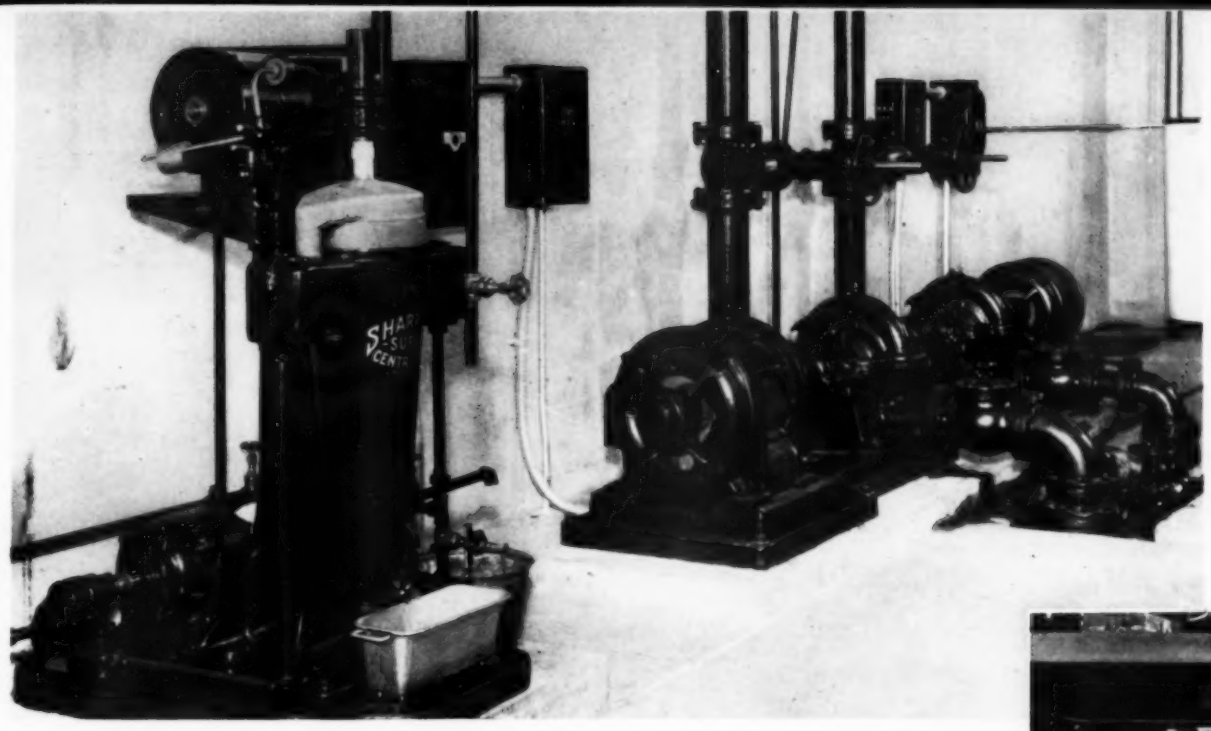
Referring to figures 7 and 10, the general arrangement of the engine room is obvious. All of the principal accessories are located in the sunken gallery and here is found a Sharples centrifuge in constant operation on the fuel line, taking the fuel from the main storage tank, purifying it, and pumping it to the day tank above the blower room where it flows by gravity to the equalizers on the engine.

The fuel handling equipment consists of a large Bassler fuel oil meter out in the yard which measures the oil as delivered from tank cars to the storage tank. Here a 300 gpm. Viking pump is used for unloading.

A smaller Bassler fuel oil meter is located in the engine room between the day tank and the engine so that a complete record is kept, first of the amount of oil delivered to the storage tank, secondly of the amount of oil delivered

This chart typifies the tremendous fluctuation in load which is thrown on this engine each day it operates and explains why a Diesel engine successfully handles the problems of this particular user.





Sharples No. 16 400 gpm. fuel oil centrifuge. A duplicate of this machine is used on the lube oil line for continuous operation in each case. In the background is Allis-Chalmers piston cooling pump and cylinder cooling pump, both driven by Allis-Chalmers motors. Crane valves and fittings are used through the plant.

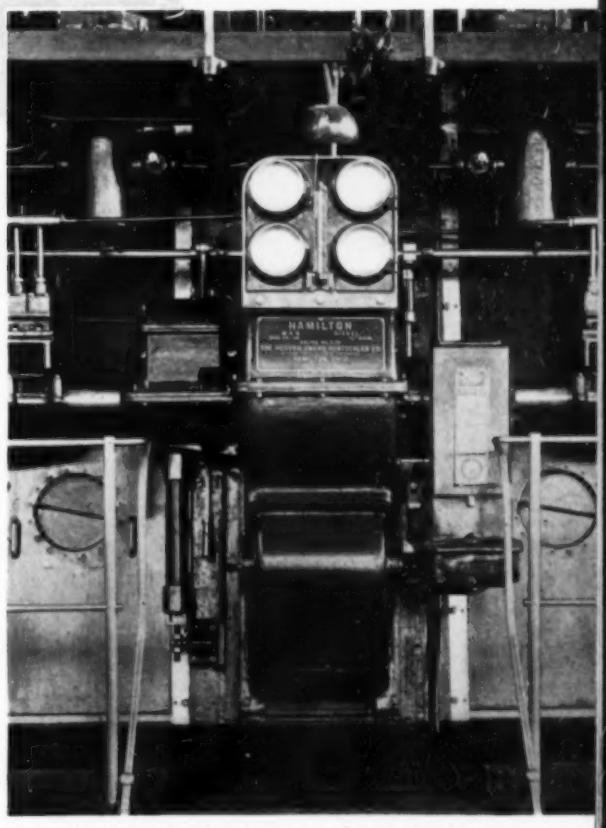
to the engine. The principal feature of this Bassler meter is that it automatically compensates for temperature differentials and registers the exact amount delivered.

The flow of lubricating oil is equally as simple. In the sunken gallery will be noticed a large lube oil day tank connected to a Northern pump, in turn connected to a Braun oil cooler, then through a pair of Elliott strainers to the engine. On the return the lubricating oil is taken through a Sharples centrifuge, purified, and returned to the day tank. Lubricating oil for this entire plant is supplied by The Texas Company, Ursa being used for cylinder lubrication and Algol No. 607 for bearing lubrication. It will be noticed that eight Manzel lubricators are used for cylinder lubrication.

One of the outstanding features of this Diesel installation is the manner in which this engine operates in parallel with the hydro-electric plants and with the steam plants, acting as it does to take the overload of the entire system and, in effect controlling the frequency of the entire system.

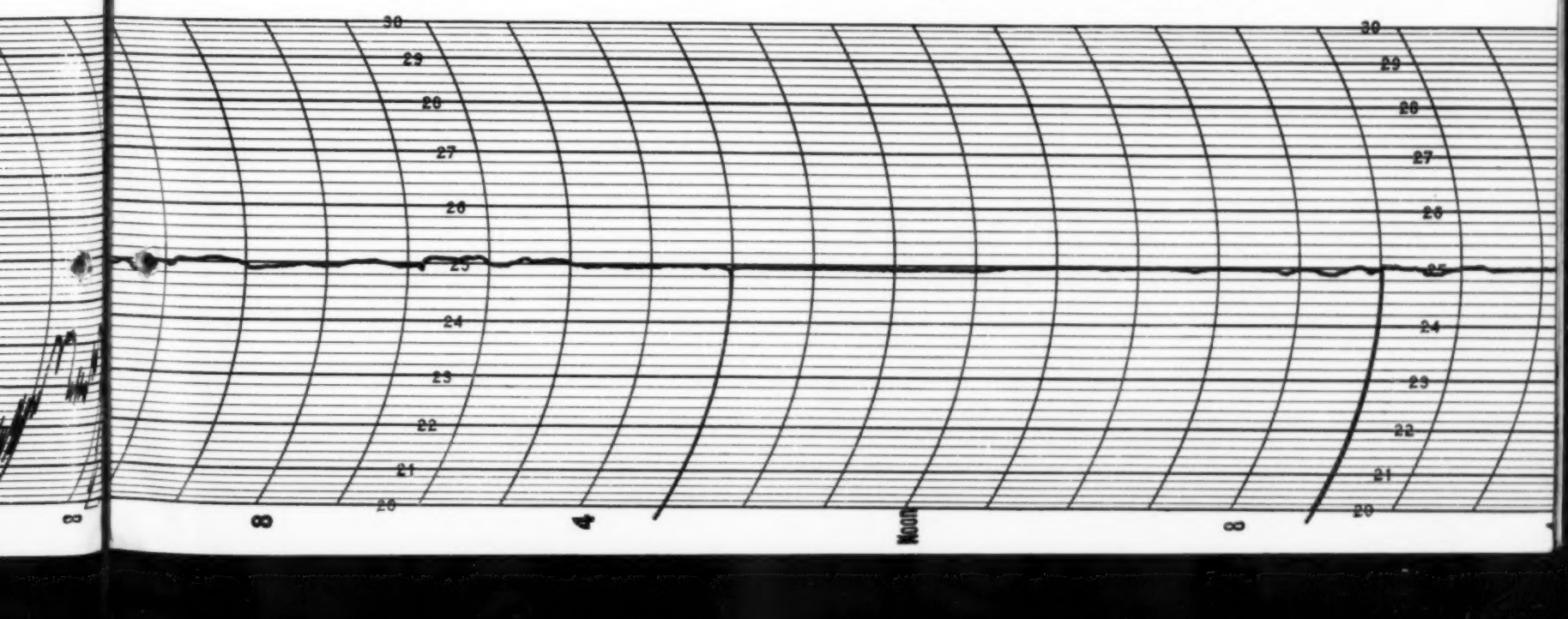
The two charts (Figs. 14 and 15) typify the average daily load fluctuations and the corresponding close control of frequency changes made possible by the Woodward governor mounted on the engine and so noticeable in figure 13.

The ability of this big engine to take these wide fluctuations in power demand has been a matter of pleasing satisfaction to the owners because that is exactly what this plant was built for and the ability of the Diesel power plant to take these violent surges of power without trouble and with no loss of time enables the rest of the system to operate at its highest efficiency.



Control station showing location of Woodward governor which does such a splendid job of control, and just under the platform to the left and right of the gauge board are two large Purolator lube oil filters.

The frequency chart hereunder typifies how splendidly the Woodward governor on this 7,000 hp. Hamilton-M.A.N. engine controls the frequency of the entire system regardless of the tremendous surges in power noticeable on the opposite chart.



CROWN ZELLERBACH C
Nine Atlas Diesel p

"Little David," 56.7 x 15 x 4.8, powered by a 4-cylinder, 8½" x 12", 90 H.P. Atlas Diesel, installed in 1925 to replace a gasoline engine.

"Ray," 42 x 9.5 x 4, purchased in 1923 and powered by a 3-cylinder, 7½" x 10½", 50 H.P. Atlas Imperial Marine Diesel.

"Diamond Z II," 57 x 16 x 8.4, an all steel welded hull built in 1937, is powered by a 6-cylinder, 9" x 12", direct reversible Atlas Diesel.

"Chief," an all steel riveted hull with twin tunnels, powered by a pair of 6-cylinder, 12½" x 16", 350 H.P. direct reversible Atlas Diesels and a 3-cylinder, 6½" x 8½", 45 H.P. Atlas Diesel Auxiliary, driving a 10 KW generator, a 600 G.P.M. pump and a 40 C.F.M. air compressor.

"Patricia," 87.11 x 21.3 x 9.3, newest of the Crown Zellerbach tow a twin screw powered by a pair of 6-cylinder, 10" x 13" direct rev Atlas Diesel which drives a 25 KW generator which supplies curr The picture above, showing the "Patricia" with five barged fuel in the swift waters of the Columbia and

R. W. Confer, Superintendent, is in direct charge of all tow boats and barges which supply the several mills, and deliver finished products to terminals for transshipment by water and rail.

TOWING pulp log rafts from their timberlands along the Columbia and Willamette Rivers to their several paper mills on the same streams, towing barges of finished products to various terminals for shipment by water and rail —this is the job in which nine Atlas Diesel powered tugs are daily engaged.

The mills of the Crown Zellerbach Corporation manufacture a varied line of products ranging from newsprint to sulphite and kraft, from toilet tissue to fibre board. Ocean freighters take these finished products from the Columbia River and Puget Sound to California and the East Coast, and to many foreign lands.

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ATLAS IMPERIAL DIESEL E

Eastern Division
115 BROAD STREET,
NEW YORK, N. Y.

Central Division
228 NO. LASALLE STREE
CHICAGO, ILLINOIS

Gloucester—Providence—Philadelphia—Baltimore—Charleston—Mian
Fort Worth—Houston—El Paso—Terminal Island—Seattle—Portla

ATLAS IM

H CORPORATION operates
Powered Tow Boats

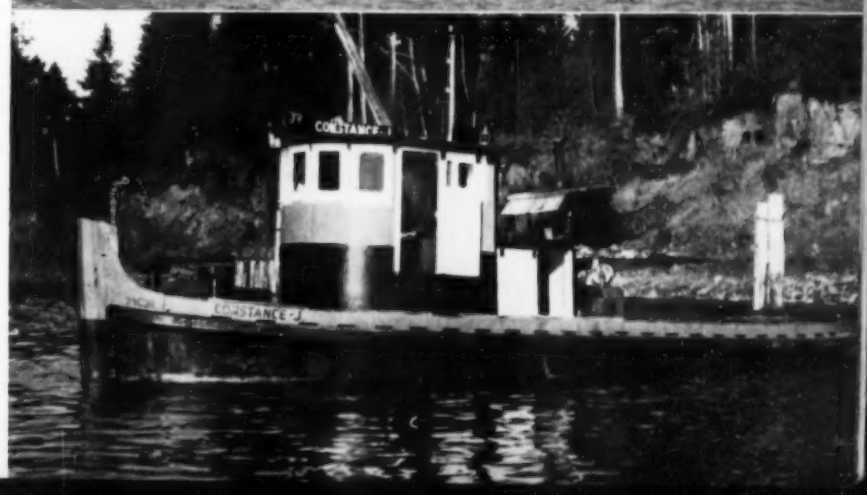
Crown Zellerbach tow boats, is a welded all steel hull built in 1937, r, 10" x 13' direct reversible Atlas Diesels. She also carries a 40 H.P. r which supplies current for the towing winch, lights, and five pumps. with five loaded fuel barges in tow, indicates the capacity of this tug of the Columbia and Willamette Rivers.

"J. H. Walker," 42.2 x 11.9 x 4.3, bought in 1924 and powered by a 3-cylinder, 8½" x 12", 65 H.P. Atlas Diesel, replacing former gasoline power.

L. R. Gault, General Manager of the Western Transportation Co., is responsible for all transportation, rates and routing for the Crown-Zellerbach interests in the Pacific Northwest.

"R. W. Confer," 54.3 x 15 x 6.6, a semi-tunnel riveted steel hull built in 1930 and powered by a 6-cylinder, 9" x 12", 160 H.P. direct reversible Atlas Diesel.

"Viola," 45 x 13.6 x 6.6, all steel welded hull, bought in 1936 and powered by a 6-cylinder, 7½" x 10½", direct reversible Atlas Diesel.



"Constance J", 45.2 x 13.6 x 6.3, a semi-tunnel all steel welded hull, powered in 1935 by a 4-cylinder, 9" x 12", 110 H.P. Atlas Imperial Diesel.

The newspaper in San Francisco must have its newsprint to get its editions onto the street—the bag factory in New York needs its paper to make its bags. Both are dependent to some extent on the ability of Mr. Gault and Mr. Confer to keep raw materials and finished products moving.

Keeping water commerce moving requires economical and dependable motive power—Diesel engines that need not be coaxed, pampered or petted; engines that will deliver tows on schedule, that are easy to care for and seldom need repair. Such service requirements are behind the choice of Atlas Diesels by the largest fleet operators on both coasts. Mistakes in choice of power are expensive—don't experiment—choose Atlas and be sure.

DIESEL ENGINE COMPANY

Central Division
. LASALLE STREET,
CAGO, ILLINOIS

Western Division
1000 NINETEENTH AVENUE,
OAKLAND, CALIFORNIA

re—Charleston—Miami—Jacksonville—Tarpon Springs—New Orleans
land—Seattle—Portland—Vancouver—Ketchikan—Honolulu—Manila

MPERIAL

THE J. W. WILKINSON

A MODERN DIESEL-ENGINED DREDGE

By GEORGE D. CROSSLEY

THE Diesel dredge *J. W. Wilkinson* was recently placed into commission by the La Crosse Dredging Company of Minneapolis, Minn. The dredge is intended for general contracting work along the Mississippi River and its tributaries.

The hull of the *J. W. Wilkinson* is of all-welded steel construction, designed by Jean M. Allem & Company, consulting engineers of Chicago, was built by the St. Louis Shipbuilding & Steel Company of St. Louis, Mo. Its length is 130 feet with a beam of 36 feet and a depth of 9 feet. The length over all is 181 feet and the draft is 6 feet.

The hull is of transverse construction with two longitudinal trusses and three transverse watertight bulkheads. The pilot house is made removable so that the dredge may pass under bridges with but 16½-foot clearance when passing from Illinois Waterway to Lake Michigan.

The propulsion power plant consists of a Busch-Sulzer eight-cylinder four-cycle Diesel engine of 16¼-inch bore and 21-inch stroke, delivering 1,000 bhp. at an engine speed of 300 rpm. The engine is equipped with American air filters, since air filtering is as important on marine installations as it is on land, a fact that is all too often overlooked.

Another Busch-Sulzer Diesel of six cylinders, of 13-inch bore and with a stroke of 17 inches, delivering 450 bhp. at an engine speed of 300 rpm., is directly connected to a 300 kw., 250 volt D.C. generator, which supplies current for the hoists, cutter and all auxiliary machinery. A third Diesel engine, a Caterpillar of 5¼-inch bore and 8-inch stroke, drives a 50 kw., 250 volt D.C. generator at 850 rpm.

A balancer set provides current at a potential of 125 volts for lighting, for the fans, etc. All pumps such as fire, bilge, cooling-water, as well as the service pumps, are electrically operated and most of them are installed in duplicate and also cross connected, so as to avoid any possibility that the dredge may be inoperative due to pump failures.

The main dredging pump is directly connected to the Busch-Sulzer engine by means of a Fast shear-pin type flexible coupling. The dredging pump is of all-steel construction with Kingsbury thrust as well as radial bearings. It has a 21-inch suction and an 18-inch discharge with a runner diameter of 76 inches for operating speeds of from 220 to 300 rpm.

The normal digging depth is 38 feet, but with a 20-foot extension, dipping to a depth of 55 feet may readily be accomplished.

All of the engines are started by compressed air, provided by electrically driven compressors.

Special attention is given to the fuel and lube oils. Hydroil purifiers and also strainers are installed in the engine room to insure an unfailing supply of clean lubricating, as well as fuel oil.

While the *J. W. Wilkinson* does not present many radically new features, it is thoroughly representative of the latest American practices in Diesel hydraulic dredge design. No living quarters have been provided for.

The main dredging pump and the Diesel engines are located in machinery wells, whereas the cutter drive and the hoisting machinery with their motors, are located on the deck. All of the ladder and spud lifting frames are pin connected and thus they may readily be lowered.

The ladder is of extra heavy construction and is attached to the bow of the dredge. No ladder well is provided.

The cutter drive is located on deck and the power is transmitted to the ladder by means of a telescopic knuckle joint. The cutter motor develops 250 hp. and has a speed range of from 575 to 900 rpm. It drives the cutter shaft through a train of Jones reduction gears, at any desired speed of from 17½ to 27½ rpm.

The dredge is equipped with a Bucyrus-Erie hoist with no less than seven drums. It is

operated by 50 hp., 230 volt. D.C. motor. The hoist has a maximum rope-pull of 25,000 lbs. and the rope speed may be varied according to need, from a low of 15 per minute to as much as 100 feet per minute.

The seven drums serve the various requirements peculiar to dredging, namely:

One drum raises and lowers the digging ladder.

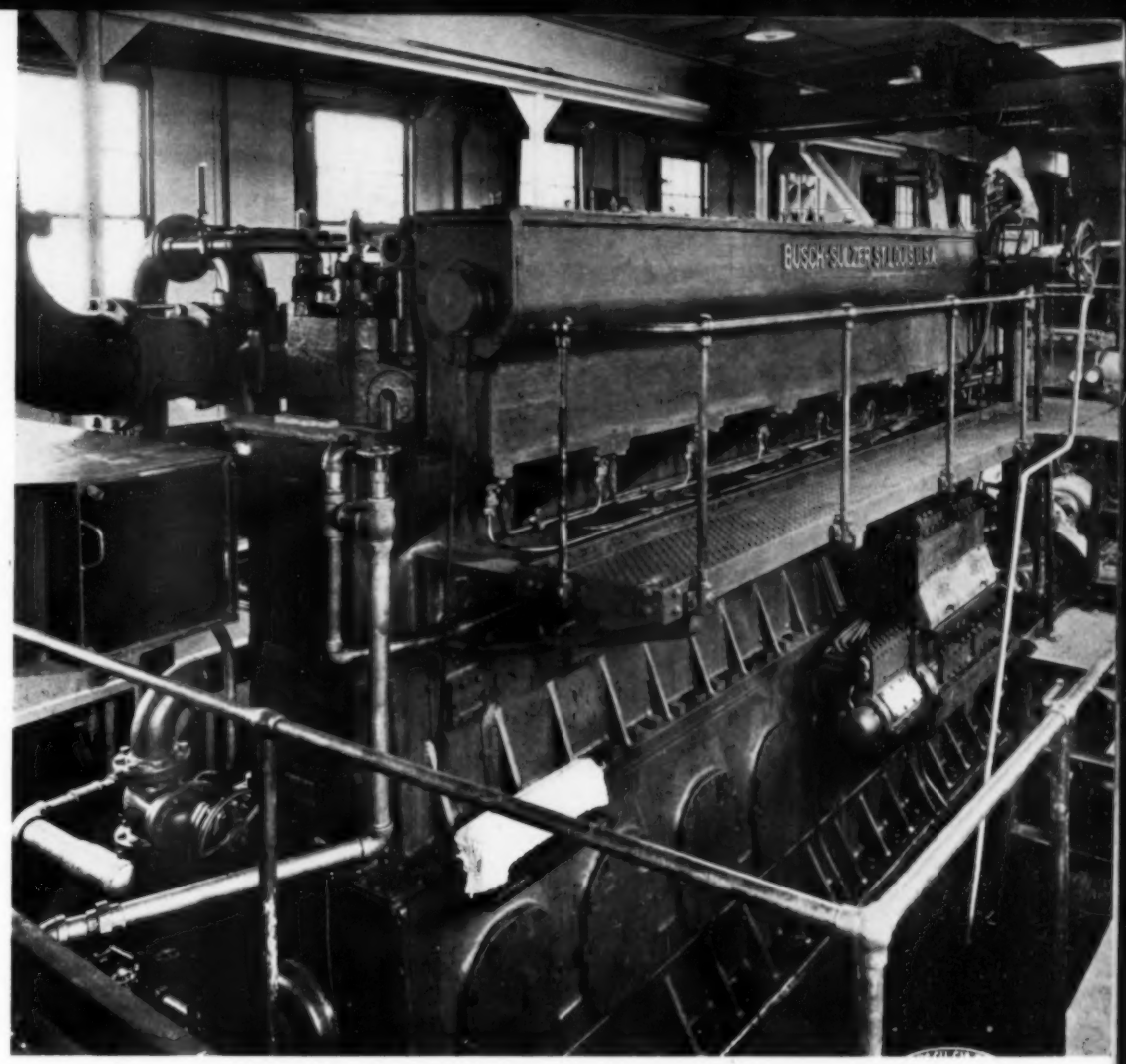
Two swing the dredge in its digging operations.

Two shift the swinging anchors by means of anchor booms.

Two drums handle the spuds.

The hoist control is unique in many respects and is somewhat of an innovation in hydraulic dredge practice. It consists of an oil-operated system developed by the Bucyrus-Erie Company in connection with drag-line excavators. All the operations of the dredge are controlled by but one man from the operating room, which is so located as to give the operator a good view of all operations. The pump pressure and vacuum gauges, the hoist and cutter control handles, are all located conventiently and in front of the operator.

The Electro Dynamics Works of the Electric Boat Company furnished all of the generators and motors used on the dredge. The main dredging pump, cutter and many of the miscellaneous castings used were furnished by the Kling Brothers Engineering Works, while the machinery was erected by the La Crosse Dredging Company.



The main power plant, a 1,000 hp., 8-cylinder Busch-Sulzer Diesel.

The dredge "J. W. Wilkinson"

Deutsche Lufthansa's new transatlantic mailplane, the "Nordstern," is a Ha 139 seaplane built by Blohm & Voss. It is powered with 600 hp. Junkers "Jumo" 205 Diesels.

TRANSATLANTIC FLIGHTS

By PAUL H. WILKINSON

TRIAL flights across the North Atlantic with Diesel-engined planes were resumed last month, with fourteen round-trip crossings scheduled by Deutsche Lufthansa. This year the 2,400-mile flights between New York and the Azores are being run on a weekly basis, approximating as closely as possibly regular airmail service across the ocean. Flights are also being made regularly over the 1,000-mile section between the Azores and Lisbon, completing the over-water trips, so that data may be obtained over the entire route between the United States and Europe. The schedule calls for a plane to arrive at New York every Monday morning and for another one to leave for the Azores the same evening.

A third *Ha 139* seaplane, built by Blohm & Voss, has been added to the "Nordmeer" and the "Nordwind," veterans of the 1937 flights. This is the "Nordstern" and, like its teammates, it is powered with four 600 hp. Junkers "Jumo" 205 Diesels. Its wing has been modified slightly, however, so that it has a top speed of over 200 mph. and a cruising speed of 175 mph., which is appreciably faster than the other planes. These "mail and freight carriers" are catapulted from the floating base "Friesenland" at New York, and from the "Schwabenland" at Horta. Between Horta and Lisbon, smaller twin-engined Dornier *Do 18* flying boats, also powered with Junkers "Jumo" 205 Diesels, are being tried out.

One would think, since these activities are recorded in the press, that people at Washington would have a fairly good idea of what progress is being made in aviation. Yet here is an interesting sidelight on the situation, which certainly speaks for itself. In the "Air Commerce Bulletin" of April 15, 1938, issued by the Bureau of Air Commerce at Washington, there is an article by Col. J. Monroe Johnson, Assistant Secretary of Commerce, entitled: "Transoceanic Flying." In this article the following statement relative to the efforts by foreign airlines appears:

"Imperial Airways and Pan American Airways each completed three round-trip crossings—two across the North Atlantic and one by way of Bermuda and the Azores, and Deutsche Lufthansa catapulted the *Nordmeer* on its way to New York."

This paper was presented before the Providence Engineering Society at Providence, R. I., on March 24, 1938, by Col. Johnson, who professes to be one of our leading authorities on commercial aviation. Yet how is it that he made no mention of the fact that Deutsche Lufthansa completed eleven round-trip crossings during 1936 and 1937 compared with our three round-trip flights? And how is it that this worthy expert failed to mention that the Diesel was used on the German planes with great success, and that it proved to be far more economical, from both fuel cost and payload

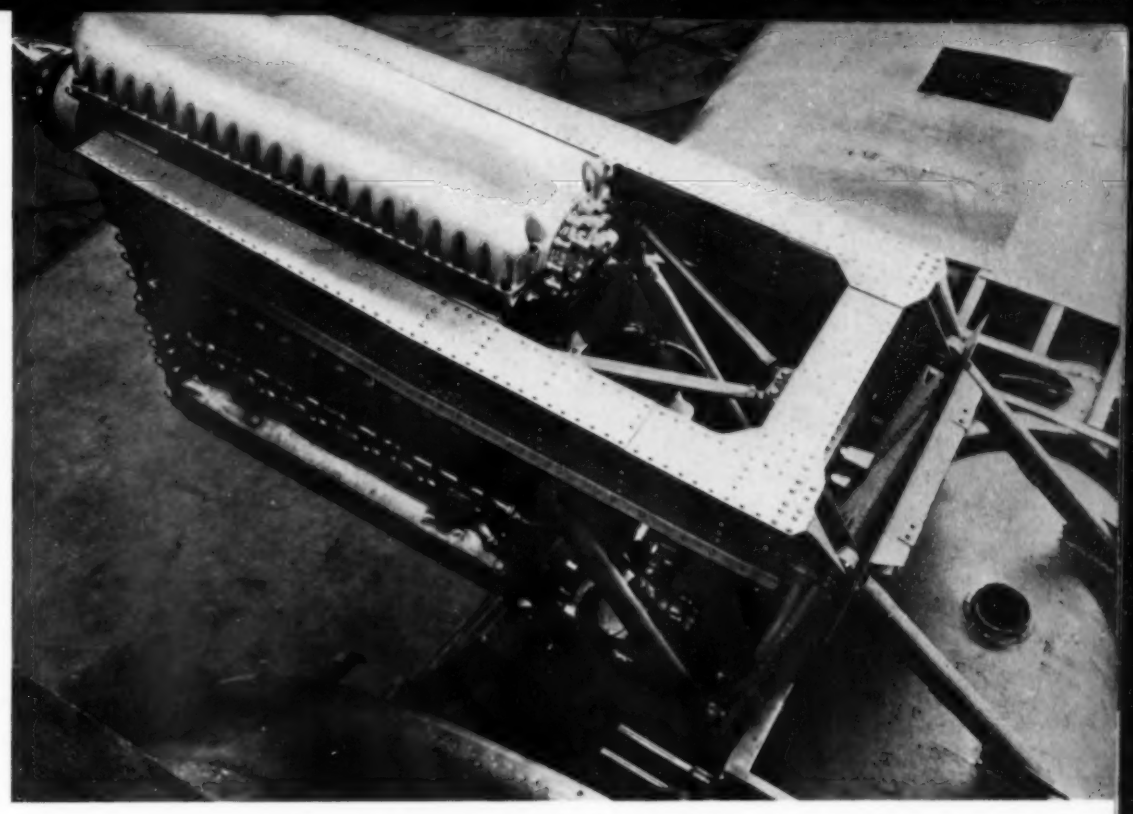
Close-up of one of the Dornier Do 18 flying boats which are being tried out on the Horta to Lisbon section of Deutsche Lufthansa's transatlantic route.

points of view, than the gasoline engine to which our air transport companies are shackled? Can it be that Col. Johnson was unaware of these achievements, or did he purposely omit to refer to them so as to cover up our deficiencies?

And now that the question has been brought up, why shouldn't we in the United States have airmail service to Europe, when last year many tons of mail could have been flown safely across the ocean by Deutsche Lufthansa, and this year their Diesel-engined planes are ready to carry still more? Surely twenty-two trial flights by these planes should be sufficient proof that the project is past the experimental stage—yet once again our government has refused permission to Deutsche Lufthansa when by all rights they should carry air mail, this year at least.

It is indeed fortunate for the progress of Diesel aviation that the United States does not have any such arbitrary powers in the South Atlantic. There Diesel-engined planes carry the mail week after week, and year after year, between Bathurst on the west coast of Africa and Natal in Brazil. Passengers, too, will soon be able to enjoy this safe and reliable means of transportation, as Deutsche Lufthansa is testing a Dornier *Do 26* flying boat for this service and expects to have it in operation this year. The *Do 26* is powered with four 600 hp. Junkers "Jumo" 205 Diesels, and can carry from six to eight passengers and about 1,000 lb. of mail. Furthermore, it is able to take off from the water and has an even better performance than the "Nordstern," due to reduced drag of its carefully streamlined hull.

Long-distance flying is becoming more and more important, as was demonstrated recently by the fine flight of Howard Hughes. He soon realized the peril of fuel shortage, however, and told how he reached Paris with hardly enough to spare. To carry enough fuel to fly there from New York, he had to take off at a gross weight of nearly 13 tons—far more than was safe for his Lockheed, which had to attain a speed of 125 mph. before it could rise from the ground. Hughes, without hesitation, pronounced "taking off from Floyd Bennett Field with such a heavy load" as "the most dangerous part of the flight." He was frank enough to admit that he had been attended by "great luck" and expressed doubt that he would ever attempt it again. If he had had a Diesel-engined plane, he would not have had to worry. The tabulation shows why the "Buckeberg" had a far better performance from the safety point of view with its relatively low-powered Diesels, way back in 1936.

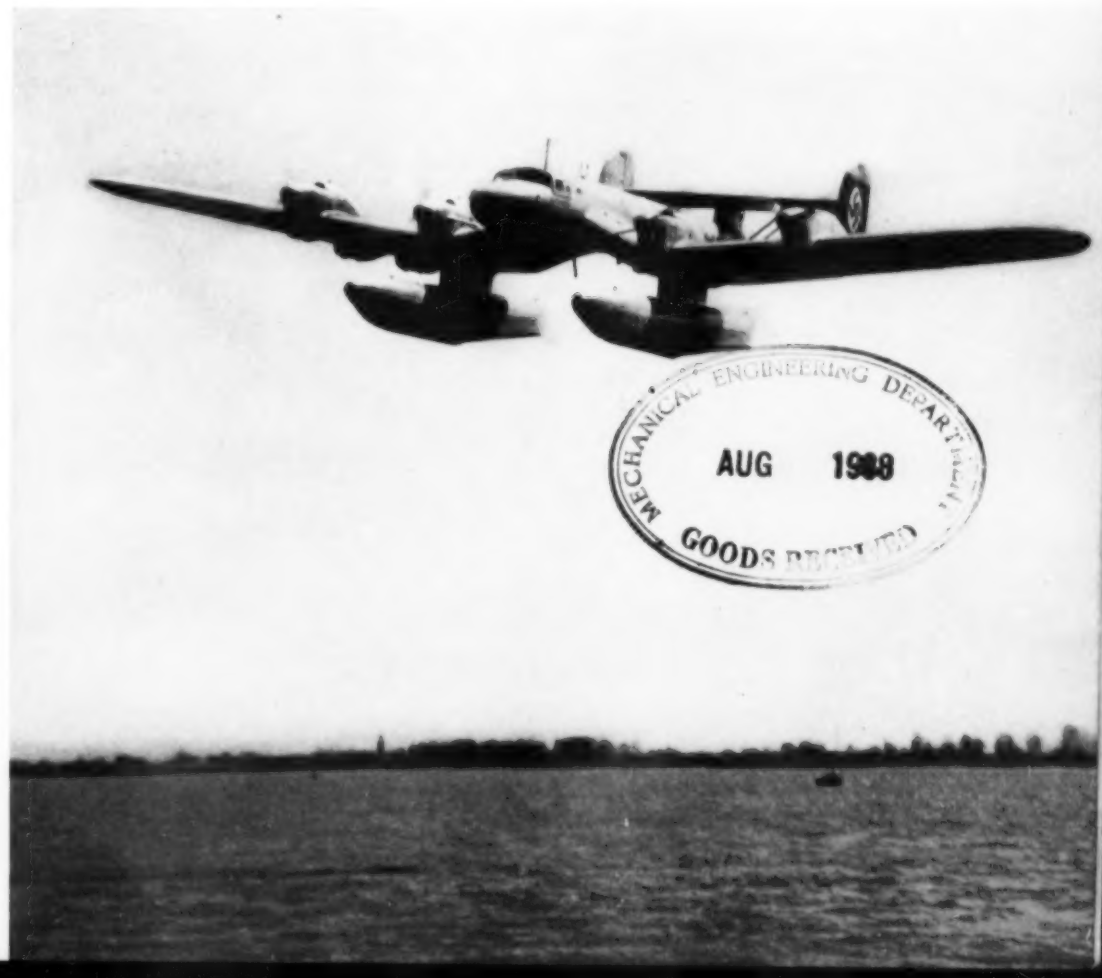


The engine installation of the "Jumo" 205 Diesel on the Ha 139 seaplane is sturdy and well-designed.

Comparison of long-range flights with Diesels and gasoline engines.

Airplane	Junkers Ju 86 "Buckeberg"	Lockheed (Howard Hughes)
Flight and mileage	Dessau–Bathurst (3,625)	New York-Paris (3,640)
Time and speed	20 hours (181 mph.)	16½ hours (221 mph.)
Engines	Junkers "Jumo" 205	Wright "Cyclone"
Type and total power	Diesel (1,200 hp.)	Gasoline (2,200 hp.)
Gross weight	21,560 lb. (17.9 lb./hp.)	25,600 lb. (11.6 lb./hp.)
Fuel on arrival	8 hours' flight	2 hours' flight
Year of flight and crew	1936 (3 men)	1938 (5 men)

Arrival of the "Nordwind" after its 2,400-mile flight across the ocean.



900 hp. EMC Road Switcher for the Missouri Pacific Railroad.

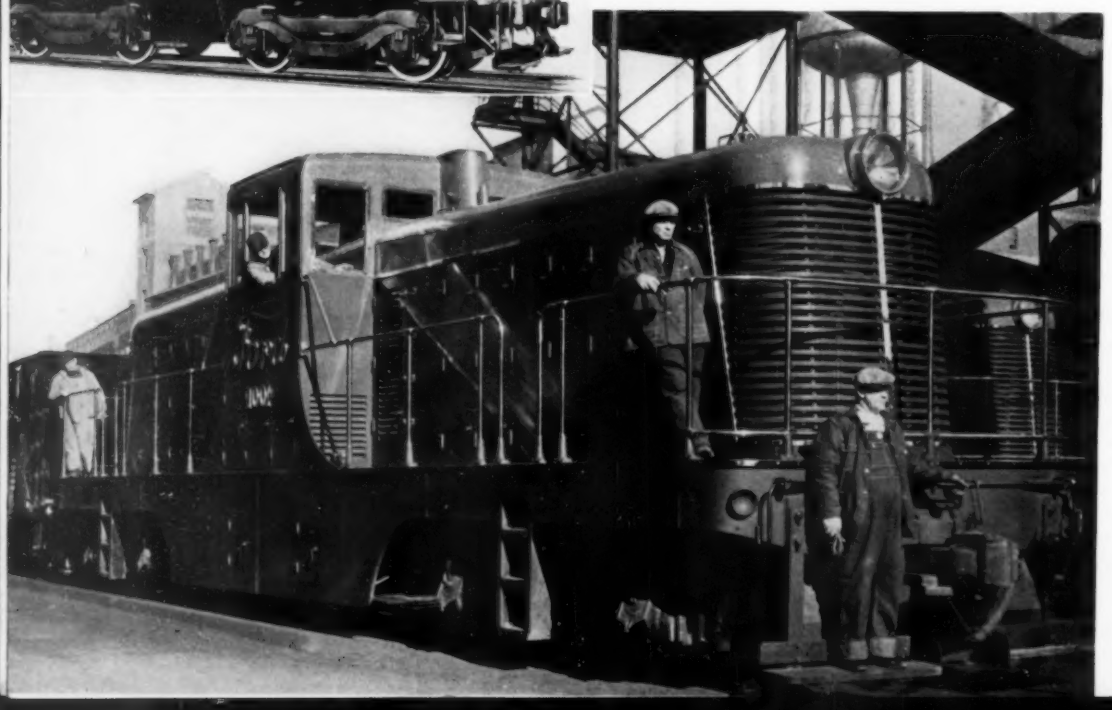
GOODBYE S

By CHARLES F. A. MANN

WHILE Diesel streamliners have stolen the railroad spotlight during the past few years, the biggest revolution in railway operating practice in the past half century has been quietly underway – that of substituting Diesel switching engines for the traditional steam dinkies that banged and clattered around our railroad yards and smoked up our choicest wholesale districts.

It has been an amazing sight to watch the way Diesel switchers have quietly established themselves in the world of railroading, without so much as a finger of protest being raised by a single railway manager. Thirteen years ago, the first Diesel switcher went to work and began saving dollars for its operator the first hour it started pushing box-cars. When Diesel passenger trains came along, great waves of controversy swept railroad board rooms and there are still 60 per cent of the American operators who stoutly deny the Diesel locomotive a place on their main line operations.

First Diesel switching locomotive built for the Ford Motor Company in 1930, equipped with a 300 hp. Ingersoll-Rand Diesel engine.



With the exception of a few transfer movements of freight trains, America and most of Europe is yet without a single Diesel operated freight train.

Fifteen or twenty years of ballyhoo about Diesels in railroading, yet no Diesel freight trains as yet!

However, all is different out in the freight yards. The amazing success of Diesel switchers is due to the fact that these busy little car-movers can, on an average, save enough on their hourly operating costs to write off their capital cost in five years. An astounding economic fact.

Diesel switching locomotives have the following peculiarly favorable advantages:

1 High yearly hours of availability.
2 Low hourly fuel, lube and operating cost.
3 High initial tractive effort.
4 Wide visibility and simplicity of operation.
5 Ease and minimum delay in shopping.
6 Quiet, odorless, flexible operation.
7 Wearing parts easily and inexpensively replaced without withdrawing entire locomotive from service, hence reduction in number of switchers needed to perform a given service and less capital investment tied up.
8 Available as transfer or branch line locomotives singly or coupled in units with one-man control for all units.
9 The above characteristics of operation make them more desirable for operation in densely populated business and wholesale areas, hence more favorable general attitude toward railroad operating them, by shippers.

But, as that sterling old war horse, Al Smith, frequently remarks, "Let's look at the record!"

In 1937, there were ordered for all railroads and industrial plants a total of 125 Diesel electric and Diesel mechanical locomotives for switching service in our great yards and terminals.

Yet, during this same period, when every op-

The latest Diesel switching locomotive for the Ford Motor Company, two of which were delivered late in 1937 by the General Electric Company, each powered with two 500 hp. Cooper-Bessemer Diesel engines.

E STEAM DINKIES

erator of steam power, every coal miners' union, Mr. John L. Lewis' boys were exerting utmost pressure, and prices were being pruned by the old-time builders of steam "locos" to stimulate sales, but 26 steam switchers were built! Further, when this is broken down, we discover that nearly half of these were built in the company shops of one big coal carrying railroad, and most of the remainder were for large iron and steel manufacturers who had plenty of coal and coke to burn at low cost, and not a single switcher which will burn fuel under a boiler was built for a large "Class A" railroad!

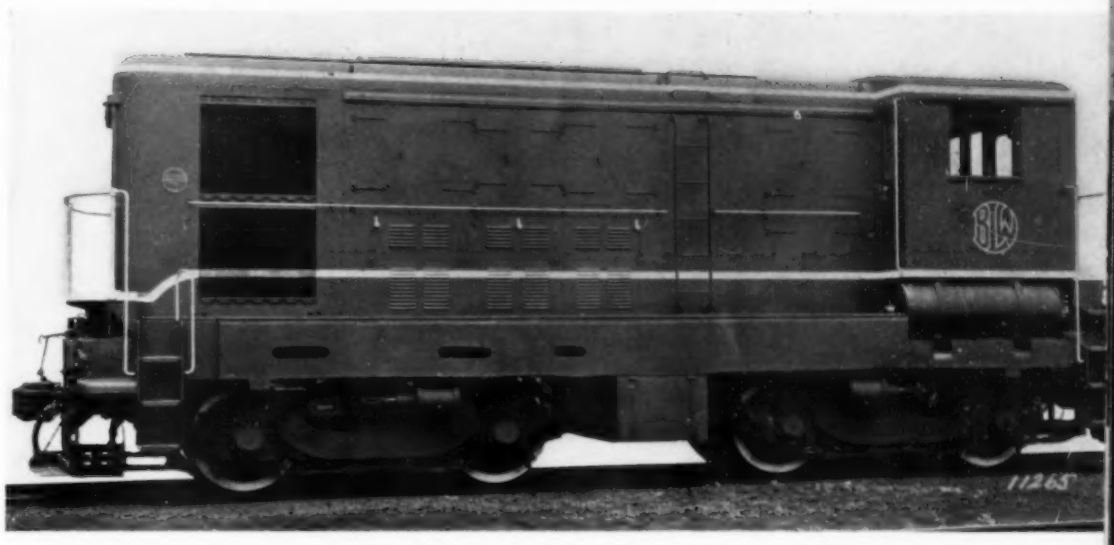
Surely, 1937 marked a turning point in American railway power.

The day of the Diesel switching locomotive is at hand, and at least one large classification of railway power has already gone fully 100 per cent Diesel!

Of course, it will take some time to wear out the old "dinkies" now in service, whose economy of renewal and repair is based on the plans of another day. But the constant pressure of having new switchers that will pay for themselves in five years, as against maintaining a fleet of old, creaky wrecks, will soon swing the pendulum over.

No story of Diesel switchers can be complete without mentioning the highly important part played by the Ingersoll-Rand powered Diesel-battery locomotives developed for the New York Central's famed West Side Freight Line, with nearly 40 in that fleet of 300 hp. jobs that were the first large fleet to eliminate steam switching in an entire section of terminal. The American Locomotive Company sold the Central Railroad of New Jersey a 300 hp. Diesel switcher, also with an Ingersoll-Rand Diesel, back in 1925, and in that same year, another with two 300 hp. Ingersoll-Rand Diesels to the Long Island Railroad. American Locomotive and Ingersoll-Rand actually began this whole business of Diesel switchers, and the industry should give them a large vote of thanks.

It remained for the big "D-pression" to stimulate this infant with so many possibilities. American Locomotive Company saw the light and hooked up with the McIntosh & Seymour people to get a good four cycle solid injection Diesel, to tie in with their vast locomotive building experience. Cummins turned up supplying Diesels to the Midwest Locomotive, and the historic Baldwin Locomotive Works have lately arranged with the Allis Chalmers people to furnish a lightweight new type Diesel, especialy designed for this service. Westinghouse, with all their facilities, have both supplied Diesels and electrical equipment and complete locomotives of all kinds in the course of their work in this field, with some notable examples.



Baldwin Locomotive Company's Diesel-electric switching locomotive equipped with a De La Vergne, Model VO 660 hp., 12½ x 15½ Diesel engine.

The largest Diesel engine ever built for railway service in the U.S.A. is the big 10 cylinder V type 2 cycle job turned out by Busch-Sulzer, first and only of its kind, for the Illinois Central, which is now used as a combined transfer locomotive and switch engine on the I. C. lakefront yard, at Chicago, where smoke hazard is banned by city ordinance. This 2,000 hp. locomotive is America's biggest switcher and a model for future application on our railroads.

Unquestionably, the most aggressive merchandisers of Diesel locomotives in the world are the boys out at Electro-Motive Corporation at La Grange, Ill. Having once determined that the proper combination of sizes were a compact 600 and 900, and possibly a larger 1,200 hp. model, the idea was to apply modern automotive mass production methods to the business of locomotives and get the price down to compete with steam power.

Since General Motors entered the railroad field with their now well-known two-cycle, valve in head, Winton-designed light-weight Diesel, and developed the EMC division to handle it, the

600 hp. EMC Switching Locomotive for the Lehigh Valley Railroad.

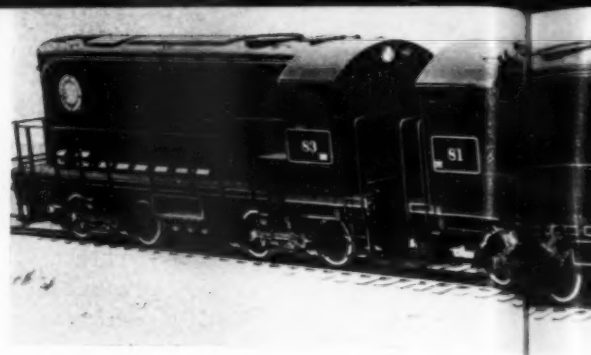
attitude of the American public toward Diesels has completely changed.

The best example of this was a speech given by an important railroad official at a luncheon. During the course of his speech he remarked: "It is certainly a novel experience to be able to call up a locomotive builder on the telephone and order a dozen switching engines and have them come rolling into the yard, ready for business, the following week."

Herein lies the key to the Diesel switcher. It is a complete unit that can be made to function as efficiently on one railroad located in Texas as it can on another in Maine, before leaving the builder's shop. Gone forever are the individual whims of one railroad operating department, whose notions cause costly added special features that do not improve operation a single bit. It is a case of producing a mechanically, thermally and electrically perfect switcher suitable for the widest possible service, and selling it like stoves or ready-made suits.

How well this new concept of locomotive standardization works out, may be shown in the order for 10 identical 600 hp. EMC switchers for the Rock Island. They all rolled up in one string, ready for business! Applying modern financing methods makes it possible to purchase locomotives on 10 per cent down and so much a month, out of income.

Soon, the famed "Equipment Trust Note racket" may even vanish before the instalment contract of purchase. But the great underlying reason for the soundness of this plan is the fact that, if Railroad "A" defaults on those Diesel switchers, with a little touching up, Railroad "B" can take them over and run them without a hitch, because they are simple Diesel "locos" which need no complicaated operating staff or



1,800 hp. Diesel-electric switching locomotive for the Birmingham and Southern Railroad, built by the American Locomotive Company and powered by two 900 hp. Buchi supercharged Alco Diesels.

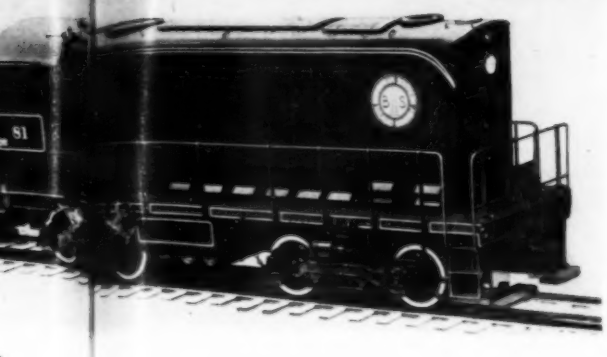
"Prima Donna" treatment to make them fit into the operation of their new owners. And you can not do this with specially built steam locomotives.

Of those 125 Diesel switcher locomotives ordered in 1937, EMC supplied 67 of the 600 and 900 hp. models. The total horsepower was 57,065.

It is safe to say, that during the next ten years 100,000 Diesel horsepower will be required to gradually replace the steam switchers each year, due to obsolescence and need for better operating economics. If but 5,000 of the oldest and most obsolete type of switching locomotives on Class 1 American railroads alone would be discarded – and this does not include the vast array of "locos" on the smaller lines, in quarries, belt lines, industrial plants, etc., with 3,000 modern Diesel switchers – the total annual saving would amount to $52,000,000 in operating expenses alone!

Such a staggering picture cannot be overlooked. The great field for switchers is in the 600 hp. class, with operating characteristics that show a starting tractive effort up to 70,000 lbs., a continuous rating at 6 miles per hour of 28,000 lbs. and 4,000 lbs. at 30 miles per hour on a faster hop up to the end of the yard with a few empties. Total operating costs on the 600 hp. locomotives for everything, including crew, fuel, maintenance, supplies, etc., come to about $1.65 per hour, or a total annual saving of about $15,000 per year over a steam switcher. Water tanks and ash pits are eliminated, and up to

Largest single order for Diesel switching locomotives recently completed by the Electro-Motive Corporation, consisting of 10 units delivered at one time to the Rock Island Railroad, each powered with 600 hp. EMC Diesel engines.



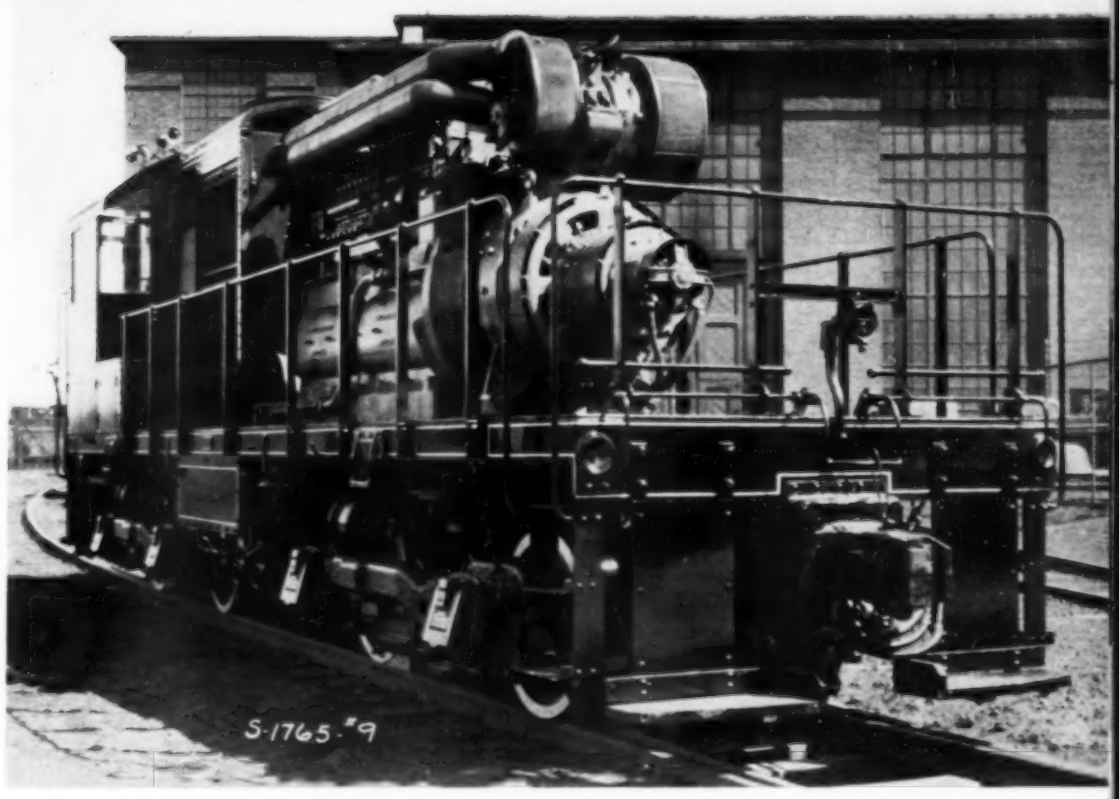
8,000 — or better — hours of operation can be obtained yearly.

Mass production seems, also, to have brought the once costly Diesel loco down within range of the steam. An 0-8-0 steam switcher weighing 140 tons was contracted for in 1937 at a price of $73,000, while a comparable 600 hp. Diesel electric switcher was contracted for at a price of $70,000. And their tractive efforts were about the same.

One more factor enters the discussion. In territories where smoke and noise are a major factor, social forces such as tenancy of nearby buildings, city ordinances, etc., will hasten the day of the Diesel switcher. In regions where fuel oil is cheap or water supply bad or costly, operating cost will do likewise. In coal mining regions, the steam switchers will hold their last stand. But on the averaged whole, the great economies of daily operation practically assure the operation of vast new fleets of Diesel switchers at an early date and the little steam "dinky" in our terminals and freight yards, will soon be a relic of the past.

Probably one of the first American railroads to lead this movement will be the Santa Fe, which started off last Fall by putting 11 Diesel switchers in service, and is now the largest Diesel locomotive power operator in America. Rumors have it, that because of their arid western end, where water costs as much as fuel, the Santa Fe may be the first to operate Diesel freight trains.

There are about an even dozen Diesel locomotive manufacturers ready to go to work on this huge task when America's railroad operators get tired of throwing nearly $40 per day out the window as a total loss on each and every steam switch engine they run.



The first supercharged Diesel switching locomotives built in this country, powered with 900 hp. Buchi supercharged, American Locomotive Company's Diesel engines. Six of these units were delivered to the Birmingham and Southern Railroad. Illustrations show the completed unit and the chassis showing engine with supercharger at top.

DIESEL-ELECTRIC RIGS

By J. E. BRANTLEY

IN regions where fuel costs are high and water inadequate in quantity, costly or of a character detrimental to steam power plants, it becomes necessary, in practicing proper economy, to resort to the use of power driven drilling rigs. The operator has a choice of several types, for example: internal combustion engines driving the hoisting equipment and mud circulating pump directly, and internal combustion engine-electric generating sets driving the hoisting equipment and pump through individual motors. These internal combustion engines may be fueled with Diesel oil, butane, natural gas or gasoline and the electric generators designed to produce either direct or alternating current. The equipment to be discussed here is a Diesel-electric power plant generating direct current to be supplied to individual motors which drive the various machines of the drilling rig.

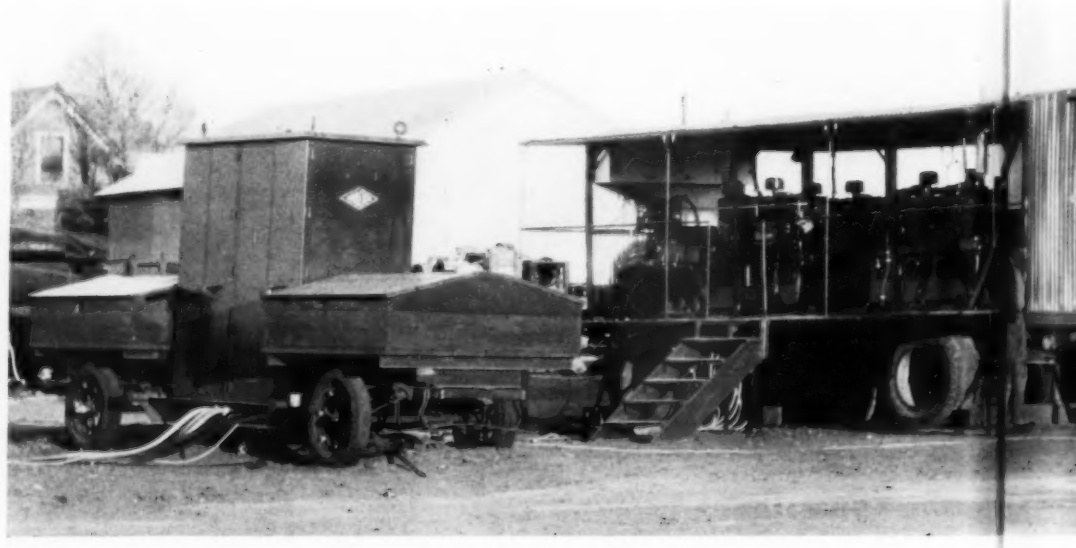
In selecting a Diesel-electric power plant there are several choices which may be made, namely: a relatively slow speed engine connected by a belt drive to a higher speed generator, a high speed engine so connected to a high speed generator, a slow speed engine connected directly to a slow speed generator and a high speed engine directly connected to a high speed generator. The lower the speed of both the Diesel engine and the generator, the greater its weight, and conversely, the higher the speed of these two machines, the lighter the weight and also the lower the cost. Each of these types of generating sets has its particular field of usefulness. Obviously, the heavier equipment is less portable and the high speed lighter equipment, particularly in small units, may be transported much more readily. The character of the work to be done, and the conditions under which it is to be done, must, therefore, determine the size and type of the equipment to be selected. The work to be done by the equipment herein discussed involves the drilling of 5,000 or 6,000 ft. holes with 4½ in. drill pipe and as deep as 8,000 ft. holes with 3½ in. drill pipe. Owing to the small sizes of the bores and the nature of the formations being drilled, approximately 150 hydraulic horsepower – or the use of a 7¼ in. by 14 in. mud circulating pump was considered satisfactory. Portability was a prime requisite and maximum hoisting speeds of minor importance.

An analysis of the work to which the rig was to be assigned led to the selection of four hig-speed direct connected units developing 60 kw. at normal rating.

These Diesel engines have eight cylinders, each of 4½ in. bore and 5¾ in. stroke, with a total piston displacement of 732 cu. in. At normal operating speed of 1,200 rpm. they develop approximately 100 hp., which may be increased to 120 hp. by speeding up to 1,400 rpm. for intermittent hoisting service. These speeds will deliver respectively approximately 90 and 108 hp. on the output side of the generator.

Each of these four Diesel engines operates a 60 kw., 1,200 rpm., 250 volt differential generator, having a five kilowatt 125 volt quill type exciter. With the variable voltage control, the engine speed is maintained approximately constant and the voltage of the generator is controlled by varying the field of the generator. This variation is accomplished by inserting or removing resistance in the field circuit. The variation and voltage on the generators varies the speed on the motor to which the generator is connected.

These generating units weigh approximately 8,000 lbs. each complete, giving a total of 32,000 lbs. for the four units. They are mounted on a 20 ton capacity three-axle trailer having six dual wheels, or 12 tires on the ground. The trailer is floored with two inch boards, covered with steel, and has a roof and ends of galvanized iron oversteel angles. The sides are so constructed that the lower half folds down as an extension of the engine room, and the upper half folds upward as a continuation of the roof. In addition to the power units and the housing, other equipment, such as starting batteries and wiring, give a total over-all weight of approximately 40,000 lbs. on the trailer chassis. As indicated in the photographs, all wires lead beneath the floor of the engine house where they are permanently fixed in conduit and flexible tubing. As a means of holding the weight off the springs and the rubber of the trailer, during periods of operation or standing idle, there are six screw jacks attached by welded plates to the frame of the chassis. When the trailer is rolled into position, the jacks are lowered, placed on six inch by eight inch timbers and screwed out until the trailer floor is level and the weight has been almost entirely removed from the axles. When not in service these jacks are folded upward and swung on chains from the frame. As a further precaution against vibration and shaking, the timbers on which the jacks rest are chained to the frame and load finders are used to hold tension between the ends of the timber and the trailer frame, as shown in one of the photographs.

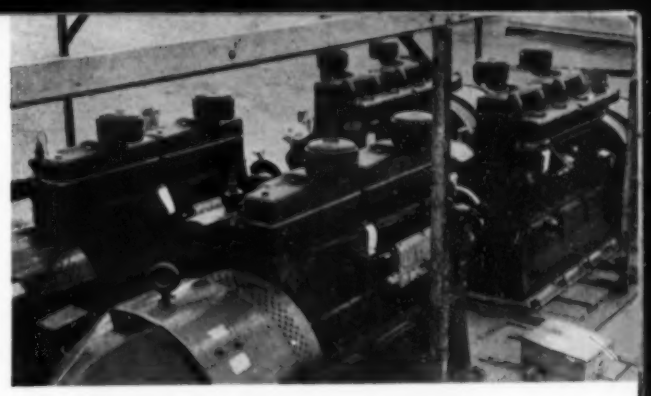


Superior Diesel-electric power plant with fuel tank and cooling tower on location.

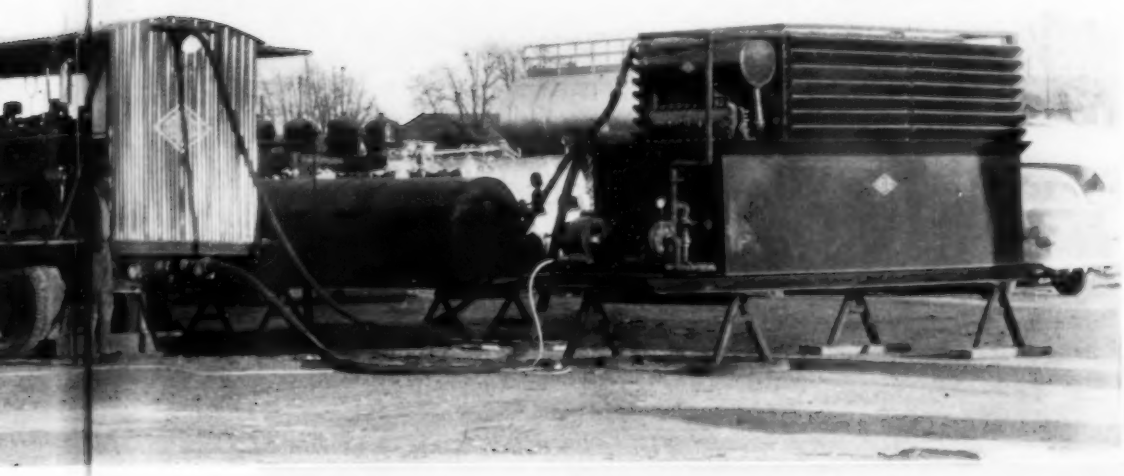
The control panels are mounted on a specially designed underslung trailer, with conductor cable boxes at either end. The fuel tank of 600 gallons capacity is mounted on a trailer.

The cooling system is composed of a heat exchanger, built up of copper tubes between cast iron ends and mounted over a steel tank twelve feet long, six feet wide and four feet deep. Water from this tank is circulated over the copper tubes of the heat exchanger, by means of a centrifugal pump driven by a three horsepower motor. A circulating water temperature of 160 deg. is maintained. This cooling system is likewise mounted on a trailer, though it is not so shown in the accompanying photograph. When set in position at the rig the power plant is placed 150 ft. from the derrick floor on the windward side, with the control panel trailer about 15 ft. from the power plant and between it and the rig. The electric power lines pass from beneath the floor of the trailer to the control panels and thence to the control boxes and switches at the driller's position on the rig. From this point, leads are run to the drawworks motor, the rotary table motor, the main pump motor, the auxiliary pump motor, the shaker screen motor and the blower motor. These controls at the driller's position are so arranged, that he may start or stop each generating unit and each motor, all from his floor position; also, the controls are such that he may apply the power from all four generators to the drawworks prime mover, any two generators to the working pump motor and any one to the rotary table motor or to the auxiliary pump motor.

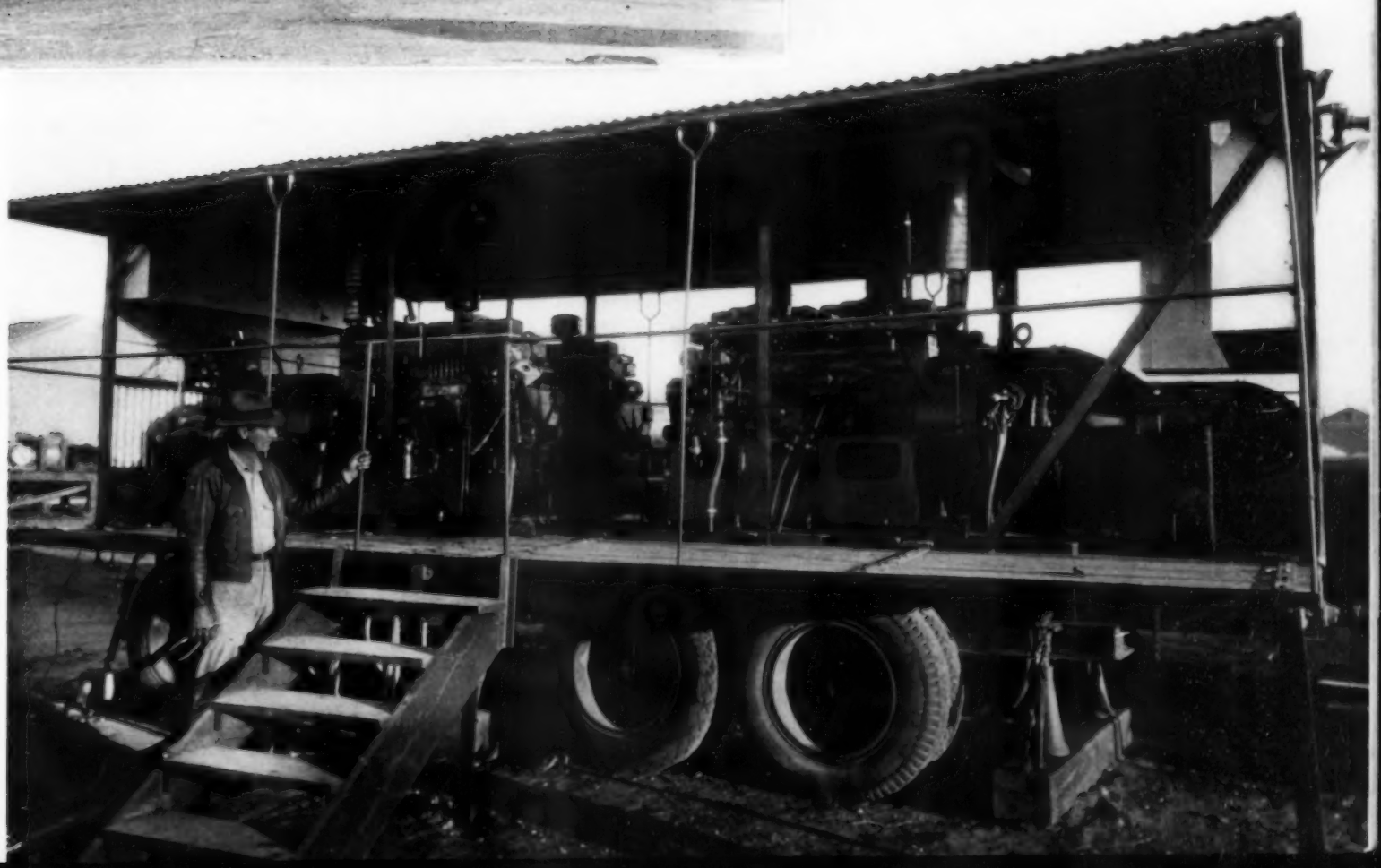
The drawworks motor is of 225 rated capacity, capable of running 100 per cent overload for itermittent service, which permits the use of all four generating units delivering approximately 400 hp. to the drawworks motor. This motor is so controlled and wound that it has 20 speed changes in each direction, varying from almost imperceptible motion to its top speed of 900 rpm. With four speeds on the drawworks this gives maximum required flexibility.



The working pump motor is of 150 hp. capacity and operates normally at 800 rpm. This motor will likewise operate intermittently at considerable overload. The pump manufacturer claims that the power end of the pump is capable of delivering 150 hydraulic horsepower at a maximum piston load of 22,000 lbs. Two of the generating units operating at 1,200 rpm. are capable of delivering 180 hp. to the prime mover of the pump and about 135 hydraulic horsepower. In order to obtain maximum fluid delivery, it is necessary to increase the operating speed of the two generators driving the pump to approximately 1,300 rpm. It is essential that the operating crews realize that a power pump can deliver safely, only so much fluid at a certain maximum pressure for a definite amount of hydraulic horsepower. If too much power is



Four-unit Diesel-electric power plant on 20-ton trailer. Superior Diesels — Westinghouse generators.



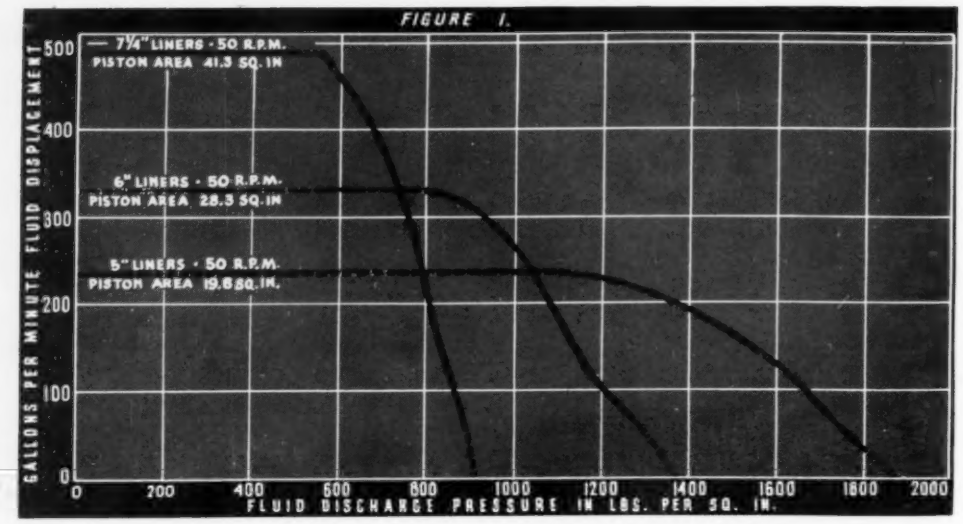


Figure 1—Pressure-volume characteristics: 7¼ in. by 14 in. power pump; normal speed, 50 rpm.; mechanical efficiency, 75 per cent; volumetric efficiency, 95 per cent; normal mud laden fluid; driven by 200 hp. D. C. motor; maximum piston load, 22,000; three liner sizes adequate.

delivered to the power end of the pump it is likely to be destroyed. The prime mover is connected to the pump by 10 V-belts of 15 hp. each. The rotary table is driven by a 75 hp. motor operating normally at 800 rpm. and is connected to the table through gears, giving a ratio of 200 rpm. on the table at normal motor speeds. This motor should be slightly larger. The table may also be driven from the hoisting motor, as usual, and the table motor may drive the hoist.

The auxiliary or service pump is operated by a 25 hp., 800 rpm. motor. This pump is 4½ in. by 10 in. in size and is used for mixing and shifting mud, cleaning pits and general service around the rig. The shaker screen is driven by a three horsepower 1,800 rpm. motor.

Each of the motors on the rig is built with a separate blower mounted on top of the motor. These were removed and a single blower mounted in a steel blower house placed 100 ft. from the rig on the windward side. From this point, eight inch 22 gauge galvanized iron piping is run to the rig, from which five inch leads are carried to the pump drawworks and rotary table motors. This assures that the cooling air going through the motors will not be gas laden, in the event the well should make gas or oil.

The accompanying Figure 1 shows the pressure volume characteristic of a 7½ in. by 14 in. power pump operated by a 150 hp. motor, into which is delivered that output of two generating units delivering approximately 100 hp. each. Figure 2 shows the hoisting curve using four generating units delivering 360 hp. into the hoisting motor. By increasing the speed of the Diesel engines, somewhat better characteristics may be had, though it may be observed that comparing Figure 2 and Figure 3, the latter of which is operated by a steam engine delivering 560 bhp., that the steam rig saves five minutes on a round trip in a 4,000 ft. hole, 12 minutes on a round trip in a 6,000 ft. hole and 19 minutes on a round trip in an 8,000 ft. hole. The saving of time is of little consequence.

In moving the rig a heavy duty truck hauls the drawworks and tows the power house trailer. Light trucks tow the other three trailers. Moving and rigging up can be done in 12 to 18 hours on a short move. The rig has drilled two wells in time equal to a steam rig powered by three 125 hp. 250 lbs. working pressure boilers.

Figure 2—Hoisting curve idealized.

Prime mover 360 bhp., drawworks, blocks and line taken at 75 per cent efficiency; 4½ in. drill pipe at 20 lb. per ft.; buoyancy of drilling fluid considered to offset friction between pipe and fluid.

Depth of Hole	Total Actual Hoisting Time		Total Time Pulling Out
4,000 ft.	25 min. + 45.00 × 35	=	0 hr. 56 min.
5,000 ft.	37 min. + 56.25 × 35	=	1 hr. 15 min.
6,000 ft.	52 min. + 67.75 × 35	=	1 hr. 35 min.
7,000 ft.	66 min. + 79.00 × 35	=	1 hr. 57 min.
8,000 ft.	82 min. + 90.00 × 35	=	2 hr. 20 min.

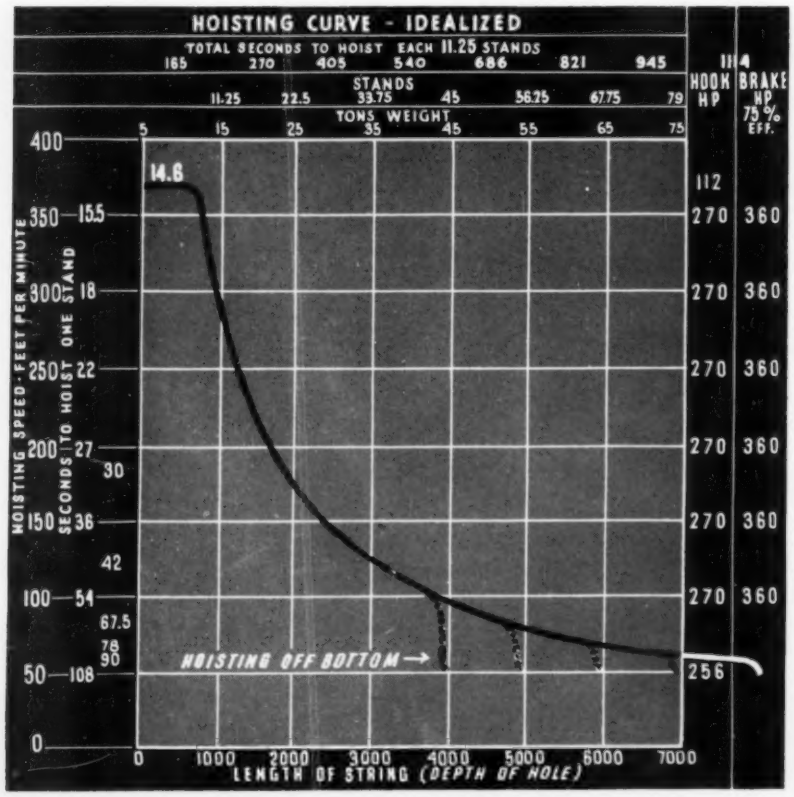
Add 35 sec. for each stand setback.
Add 5 min. for each kelly setback.

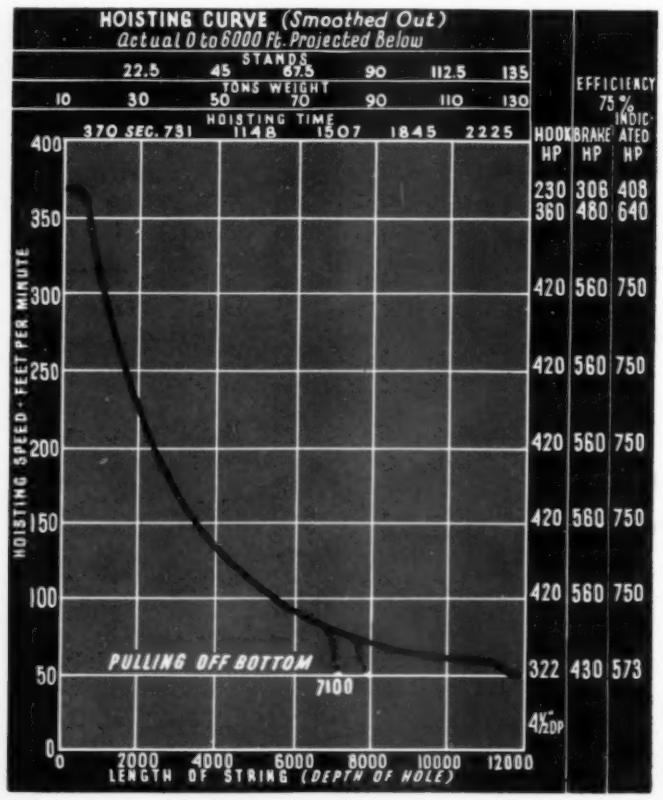
Figure 3—Hoisting curve (smoothed out).

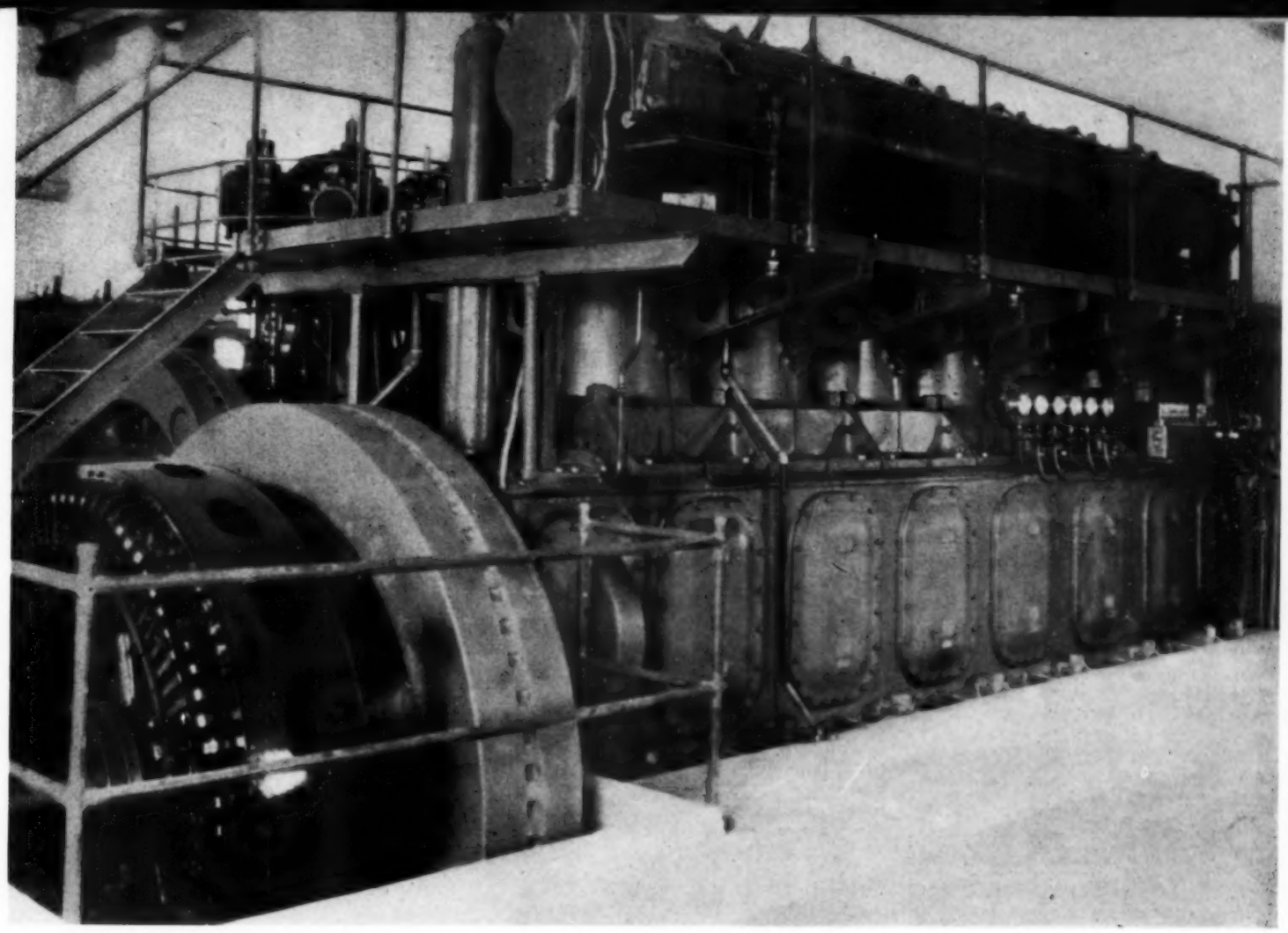
11 in. by 11 in. twin cylinder, slide valve, babbitt bearing engine on 250 lb. dry saturated steam; drawworks blocks and line taken at 75 per cent mechanical efficiency; 4½ in. D P weight 20 lb. per ft. buoyancy of drilling fluid considered to offset fluid friction.

Depth of Hole	Total Actual Hoisting Time		Total Time Pulling Out
4,000 ft.	18 min. + 45.0 × 35	=	0 hr. 51 min.
6,000 ft.	38 min. + 67.5 × 35	=	1 hr. 23 min.
8,000 ft.	63 min. + 90.0 × 35	=	2 hr. 1 min.
10,000 ft.	93 min. + 112.5 × 35	=	2 hr. 39 min.
12,000 ft.	130 min. + 135.0 × 35	=	3 hr. 31 min.

Add 35 sec. for each stand setback.
Add 5 min. for each kelly setback.







600 hp. Worthington Diesel Engine

PERRY, OKLAHOMA

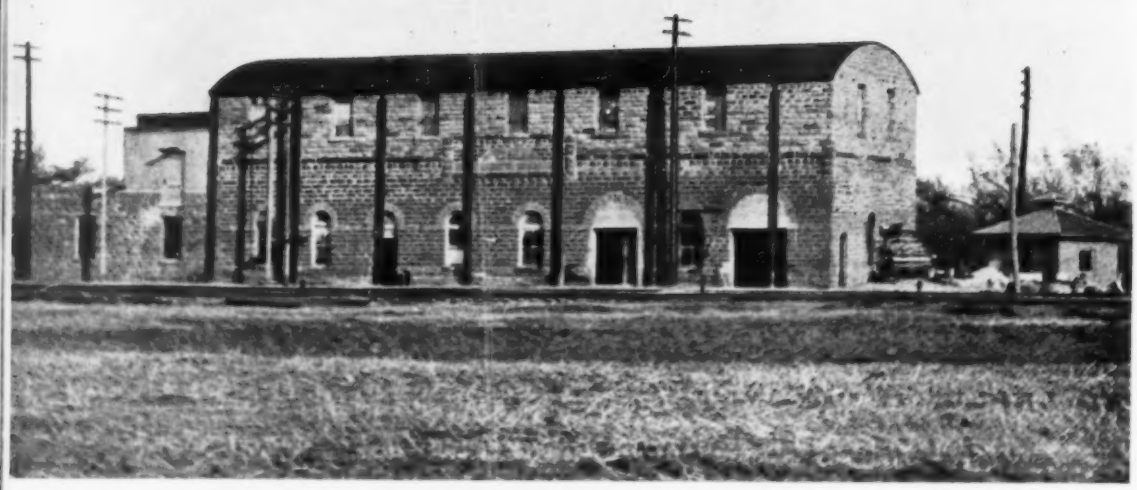
By ORVILLE ADAMS

THE city of Perry, Oklahoma, has owned and operated its own utilities with Diesel engines for more than twenty years. During this period the plant has been operated at a very low fuel and oil cost, and has earned many times the original cost of the plant in net profits to the city. The result has been that the town has paid no general taxes, and in addition has had considerable money during the depression years to spend for necessary improvements and extensions. The repair and maintenance cost on the engines have been one of the lowest on record.

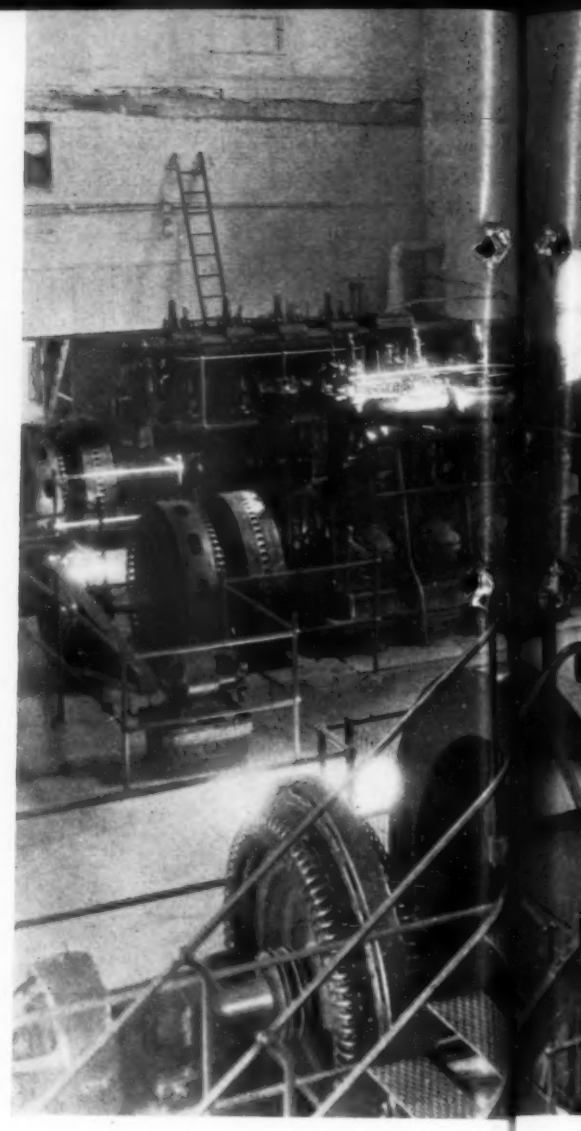
It was one of the first towns in the State to install Diesel engines in its municipal light and water plant, having bought two 180 hp. 3 cylinder air injection, Busch Sulzer Diesel engines in 1918. In three years 'time the load exceeded the capacity of the first two units, and a Fulton, air injection, 3 cylinder, 300 hp. Diesel was installed in 1921. With the plant Dieselized for improved and cheaper service rates, the town entered a period of rapid growth, which during the next three years required an additional engine. This time a 600 hp. 6 cylinder Worthington air injection Diesel engine was installed and started operation in 1924. With this addition to the plant capacity, and number of units, it became possible to handle the load efficiently and at the same time have available sufficient standby capacity to assure reliability and meet the variable load conditions of municipal lighting.

Only one set of liners in one of the Busch Sulzer engines have been replaced. The other engines are operating on the original set of liners with a liner rate of wear reduced to a very low point, the possibilities being that replacement of these liners will be deferred for a number of years as a result of the use of the Double Seal rings, and continuous running of the centrifugal fuel and lub oil purifiers.

The general good results and success in the operation of this plant is due to careful and competent operation, good lubrication and combustion conditions made possible by air injection, according to the chief engineer. When the liners had worn sufficiently to permit blow-by and leakage of the power gas, Double-seal rings were installed in the Fulton and the Busch engines in 1933. For five years these engines have been operating with restored mechanical efficiency practically equal to that of the original condition, while the rate of



Perry, Oklahoma, Municipal Electric Plant



liner wear has been reduced, operation improved, and better economy realized.

New Engine in Prospect

However, the load on the plant has gradually increased, and three of the engines, twenty years of age, are rather small for the present demand. As a result the city is planning on the installation of an additional engine sometime during the current year, although no bids have been asked for at this time. A large engine sufficient to carry the peak load capacity will likely be selected, according to the engineer in charge. As shown in the load curve, Fig. 3, the present peak-load exceeds the capacity of any two of the units which may be combined. This would indicate the application of at least a 750 to 1,000 hp. engine, in order to afford sufficient capacity for peak load and standby of duplicate capacity combinations for all loads.

One of the advantages of the Diesel engines, however, was pointed out by the engineer. The small engines may be retained in the plant and operated when needed, and used as standby capacity without making any outlay for this purpose. The cost having long since been written off, the city can afford to keep the engines, even though they are more than twenty years old. On the other hand, these engines operate with an efficiency equal to any modern engine, and consequently, there is always a demand for such second hand engines at attractive prices by certain classes of industries which can not buy new engines. There is an immediate market for the engines at prices ranging from one-fourth to one-third the original cost. The adage that Diesel engines are rarely junked until some major breakdown renders their rebuilding impractical, still continues to be true. The city may recover considerable money in the sale of the engines.

Financial Aspects

For a number of years, the operating cost of this plant has not varied to any great extent. According to Mr. P. S. Daniels, who supplied the writer with the figures taken from the last annual report of the light and water department, of which he is superintendent, the city is collecting close to $100,000 a year in revenue, more than half of which is actually net profit. This has been going on for more than a decade, and practically, the city is receiving its light and water at half the rates shown on the rate schedule in Fig. 4, for the money comes back to them in net profits, which reduce taxes. An annual report is made on the financial condition of the light and water department, and from this report, the writer has abstracted the following operating cost of the light plant, the profits from the operation, together with the gross revenue from the water plant. The figures are summarized as follows:

Operating Cost 1937

228,209 Gals. Fuel Oil	$ 6,830.75
620 Gals. Lube Oil	263.19
892 Gals. Crankcase Oil	235.81
96 Gallons Compressor Oil	40.59
Plant Supplies	520.31

PERRY WATER AND LIGHT DEPARTMENT — STUB

FOR MONTH OF

Service Discontinued if not paid by 10th of this month. Bring this Card. If remitting by mail cut off Stub and enclose with your remittance.

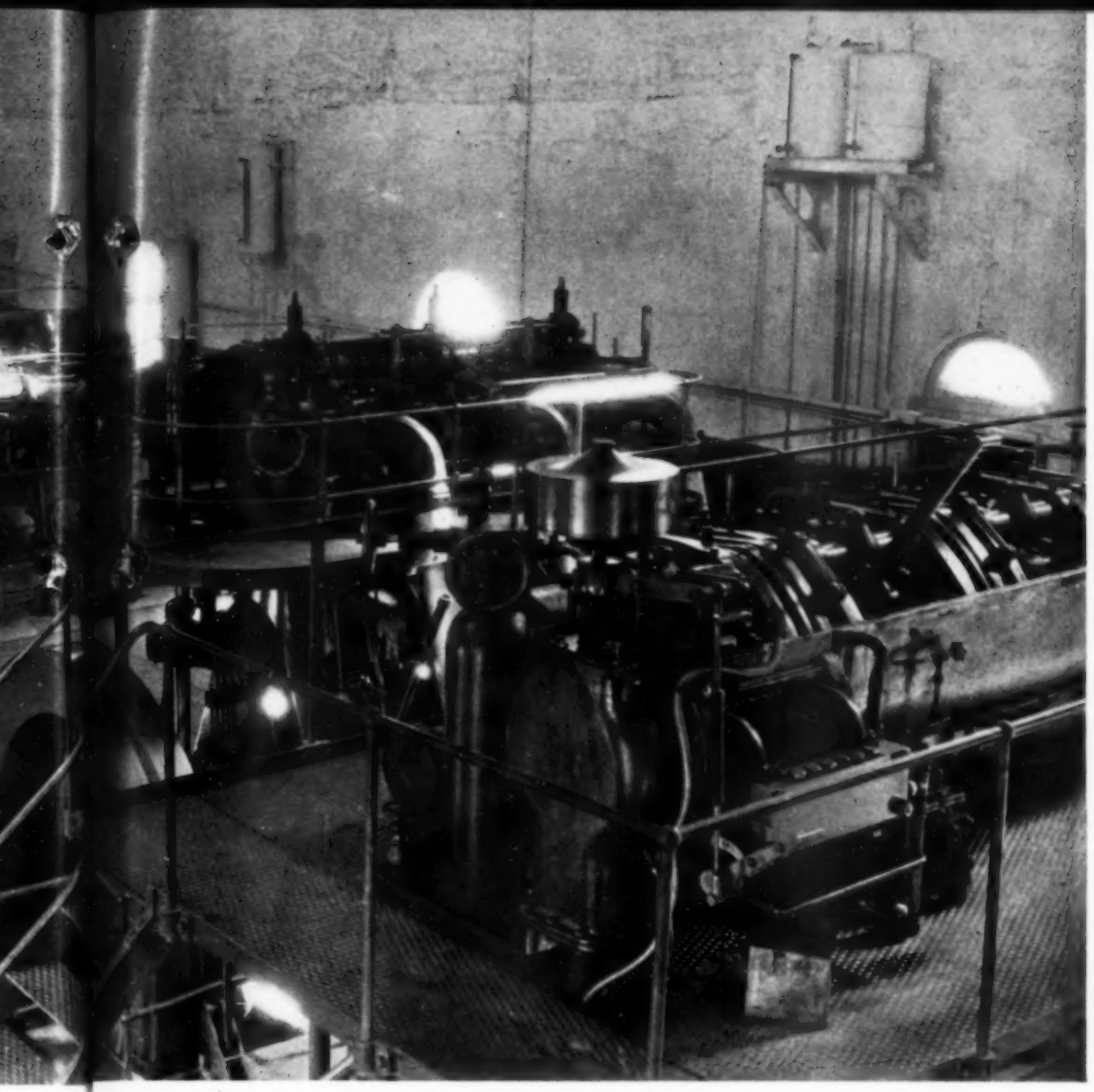
LIGHT RATES	METER READINGS—LIGHT
First 100 kw hours..... 5c	This Month Kw
Next 400 kw hours..... 4c	Last Month Kw
All over 400 kw hours....3c	Total
Minimum per Month..$1.00	

POWER RATES PER KW HR.	METER READINGS—POWER
First 100 kw hours.....04	This Month Kw
Next 400 kw hours.....035	Last Month Kw
Next 4,500 kw hours....03	Total
Next 5,000 kw hours....02	TAX
Over 10,000 kw hours...01	
Min. 50c per 1-2 h. p. per meter per mo.	

WATER RATES	METER READINGS—WATER
1000 cu. ft. or less per 100..25c	This Month cu. ft.
1000 to 3000 cu. ft. per 100..22c	Last Month cu. ft.
3000 to 6000 cu. ft, per 100..20c	Total
6000 to 100,000 " per 100..15c	
Minimum per Month.. ..75c	

NOVEY PRINT — Total Light, Power and Water....$ — $

Rate Card, Perry, Okla., Municipal Electric Plant.



Interior View of the Perry, Okla., Municipal Plant.

Production cost per kw.-hrs	$0.00538
Kw.-hrs. per gallon	9.87+
Production cost per M. gallon water	$0.0506

Auxiliary Equipment

The plant is fully equipped with every essential auixliary, including such important adjuncts as Brown Instrument Company Pyrometers, two De Laval centrifugals for lube and fuel oils, respectively, and Reed air filters. Also water treatment appartus and the like. The fuel oily is stored in large underground tanks, from which it is passed through a number of strainers to the day tanks. The engines are cooled from water in the water works reservoir located adjacent to the plant, by means of spray equipment which keeps the total reservoir capacity at a low temperature. The arrangement has proven economical and efficient.

The superintendent and the city administration have fostered the policy of keeping the people fully informed as to the details of the plant operation. An illustration of this is the monthly light and water bills, shown in Fig. 4, which is printed on a regular government postal card and mailed to the customer. Along with the bill for the month, showing the distribution of the current consumption for the month, is the schedule of rates on which the bill is based. Every citizen knows exactly how the total bill is arrived at and has been educated to understand the application of the simplified rate schedule in effect. This method of keeping the consumer fully informed has resulted in close cooperation and better appreciation on the part of the citizens of the municipal utilities. Once a year, or semi-annually, reports on the fiscal condition of the operation are published or made available through an audit of the records.

Very accurate cost records on the Daily Power Station Log have been kept and are available for twenty years back. Every necessary item in connection with the operation of the engines and the plant is recorded by each shift, so that a complete breakdown of the record is available at all times. The engineer also makes it a practice to record hourly on the curve the power factor, as well as the load on the plant. This affords a careful supervision of the operation, and is a practice that should be more generally recognized.

Engine Repairs	411.34	
Building and Equipment	35.12	
Labor	3,267.60	
New Equipment	520.13	
Total Electric Plant Operation		$12,124.83
Total kw.-hrs. generated	2,252,760	
Kw.-hrs. used in Electric Plant	85,116	
Kw.hrs. used in Filter Plant	147,452	
Extra Pumping for CCC Camp	120,020	
	352,588	
Kw.-hrs. Delivered		1,900,172

Distribution Costs

Electric Lines	$7,644.83
Street Lights	1,165.64

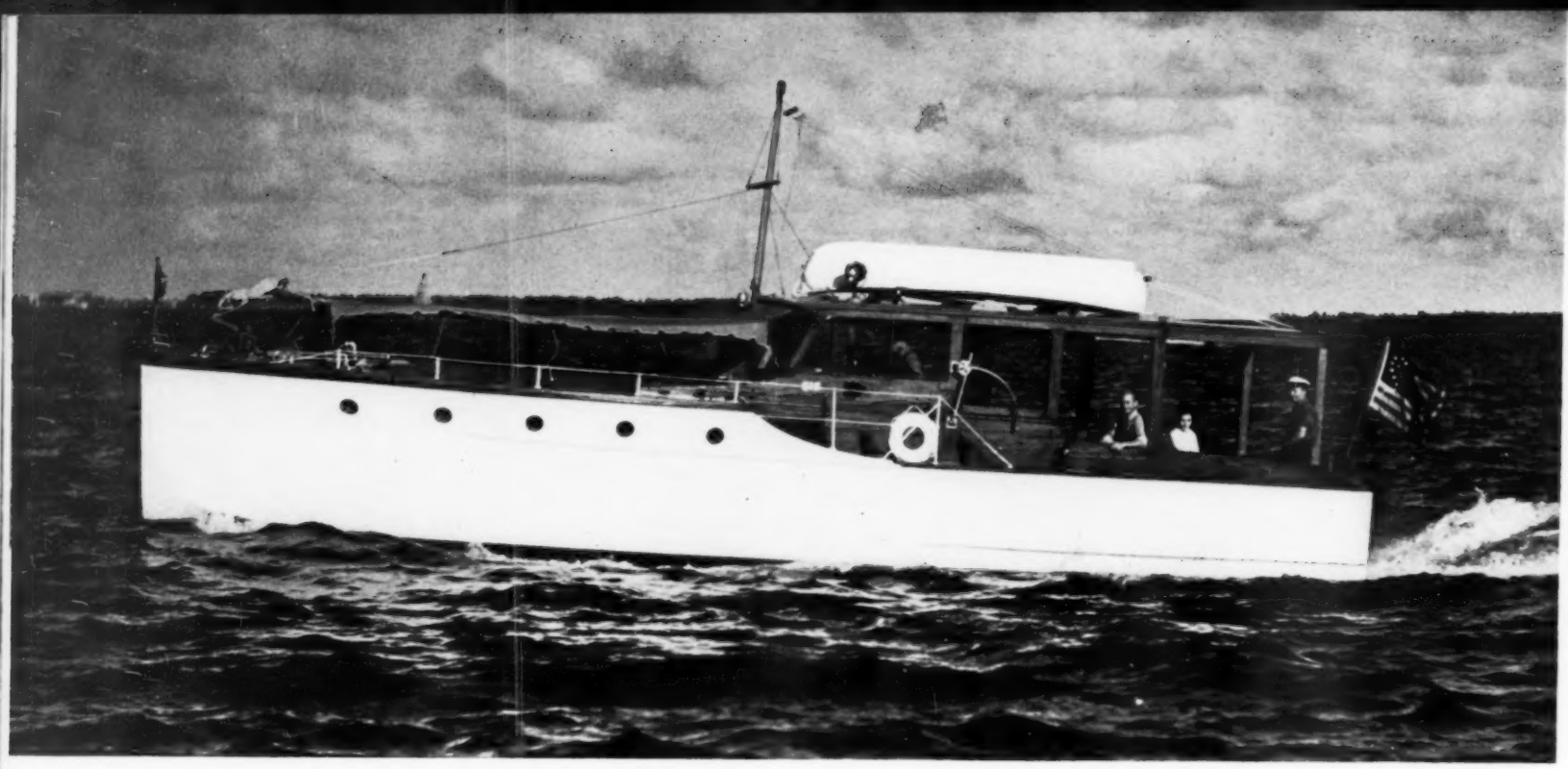
Disposition of Current

Kw.-hrs. sold for year	1,336,189
Loss	248,553
Street Lights metered kw.	312,826
Sewer Plant	2,704
Total kw.hr. delivered	1,900,172

This net kw.-hrs. available for sale to the citizens earned for the light department a total of $71,314.41, to which is added $18,011.84 for the sale of water. This sum of money is paid by 1,692 electric customers and 1,241 water consumers. Out of this is paid the operating cost shown above on the light plant, and in addition the office expense as follows:

Salaries	$4,036.90	
Supplies	1,250.66	$5,287.56

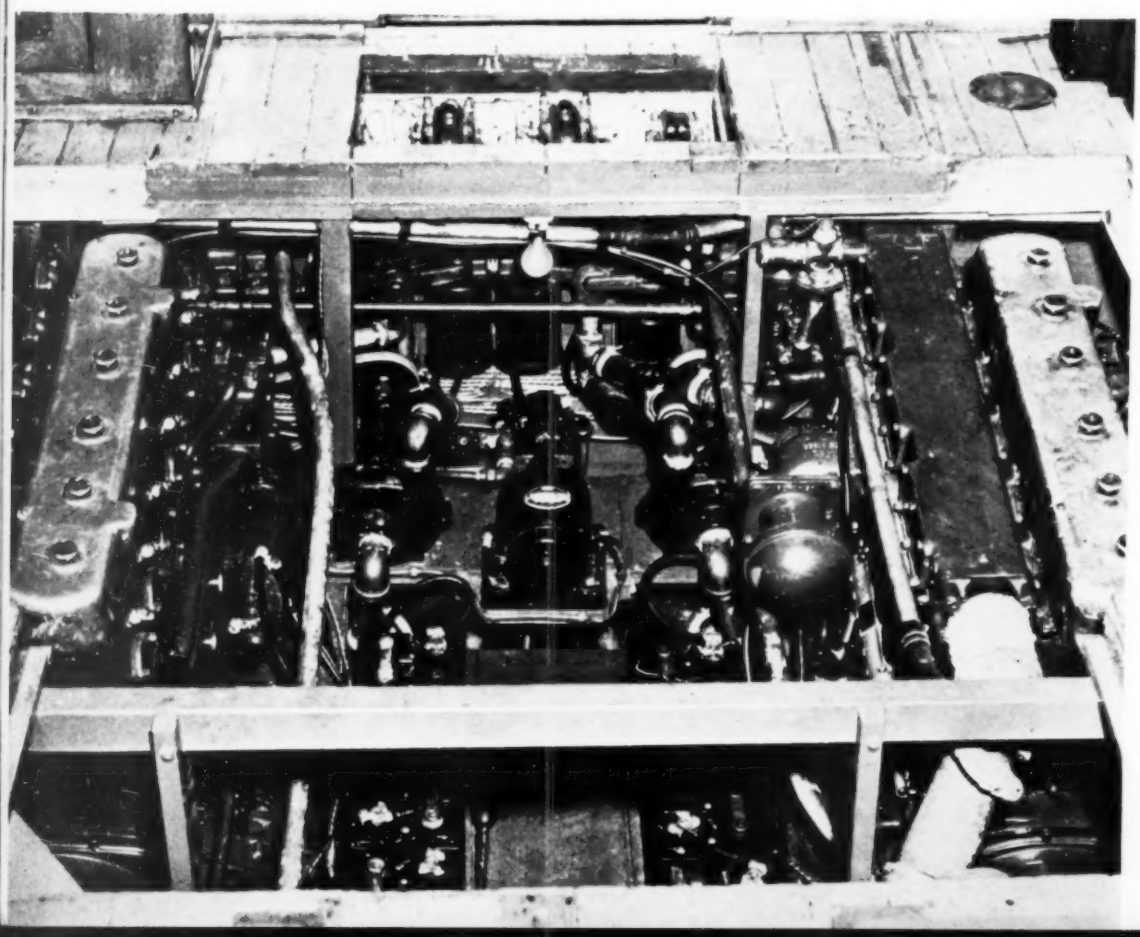
This makes a total operating and administrative cost for both the light and water department of $48,330.73, which, when deducted from the gross receipts of $91,327.73, leaves a very nice profit on the combined utilities operation. For the year of 1937, the city had a balance over and above operation and distribution cost of $39,975.23. Such has been the situation for more than a decade, and indicates a profit of around 50 cents on every dollar paid in by the citizens for utilities service and which comes back in net profits to reduce taxes and improve the city. From these figures, Mr. Daniels shows on his annual report the following cost per kilowatt hour and thousand gallons of water supplied.



A SMALL DIESEL CRUISER

By GEORGE D. CROSSLEY

Two 95 hp. Buda-Lanova Diesels side-by-side.



THE *Sis* was designed and built by the Wheeler Shipyards and is owned by Mr. E. V. Richards of New Orleans, Louisiana.

She has recently been re-powered with two Buda-Lanova six cylinder Diesels of four inch bore and five and one-half inch stroke, rated at 95 hp. Both engines use two-to-one reduction gears and swing propellers of 24 inch diameter and 24 inch pitch. At an engine speed of 2,000 rpm., the *Sis* has a speed of 14 mph.

THE BIG BEAR MARKET

By B. J. VON BONGART

JUST as the dry goods store of our grandfather's day was superseded by the department store, so the grocery store of our father's day is giving way to the modern super-market.

These modern developments may be termed innovations, yet, they did not come about over night nor are they the result of a sudden change. Rather they are the outcome of slow development, dating far back into antiquity.

The merchandising methods in vogue today, the catering to the buyer's whims, the lavish display of a sheer endless variety of foods, household goods and personal effects, are but the logical culmination of a business psychology aimed at satisfying customers, and thereby assuring the vendor's continual success.

A super market such as the Big Bear at Paterson is not what is usually known as a store, it is an institution occupying a floor space in excess of an acre, 48,000 square feet to be exact. One thousand customers can be served per hour, and the weekly attendance of shoppers averages 30,000! It cannot be designated as a local mart since it draws customers from a radius of 20 miles around.

The salient features of the Big Bear Market may be summarized as follows: Widest selection of advertised and unadvertised brands; self-service, hence total absence of high-pressure salesmanship; quick turnover due to mass sales, hence "fresh" merchandise; low overhead, hence lowest prices.

Mr. Harry M. Goldstein, vice-president of American Grocery Company, owners and operators of the Big Bear Markets, states: "The name 'Big Bear' was chosen for our first market in 1932, at the very depth of the depression when Wall Street 'bears' forced stock prices down. We intended to bring down the high cost of living. Naturally, in operating Big Bear units, an important item of expense is electric current. Our markets occupy large areas and are open every evening until nine. Since brilliant lighting is essential in order to give our markets an attractive appearance, it is therefore obvious that lighting current consumption is heavy. A large amount of electric current is also needed to provide for refrigeration in the meat, dairy, and fruit departments.

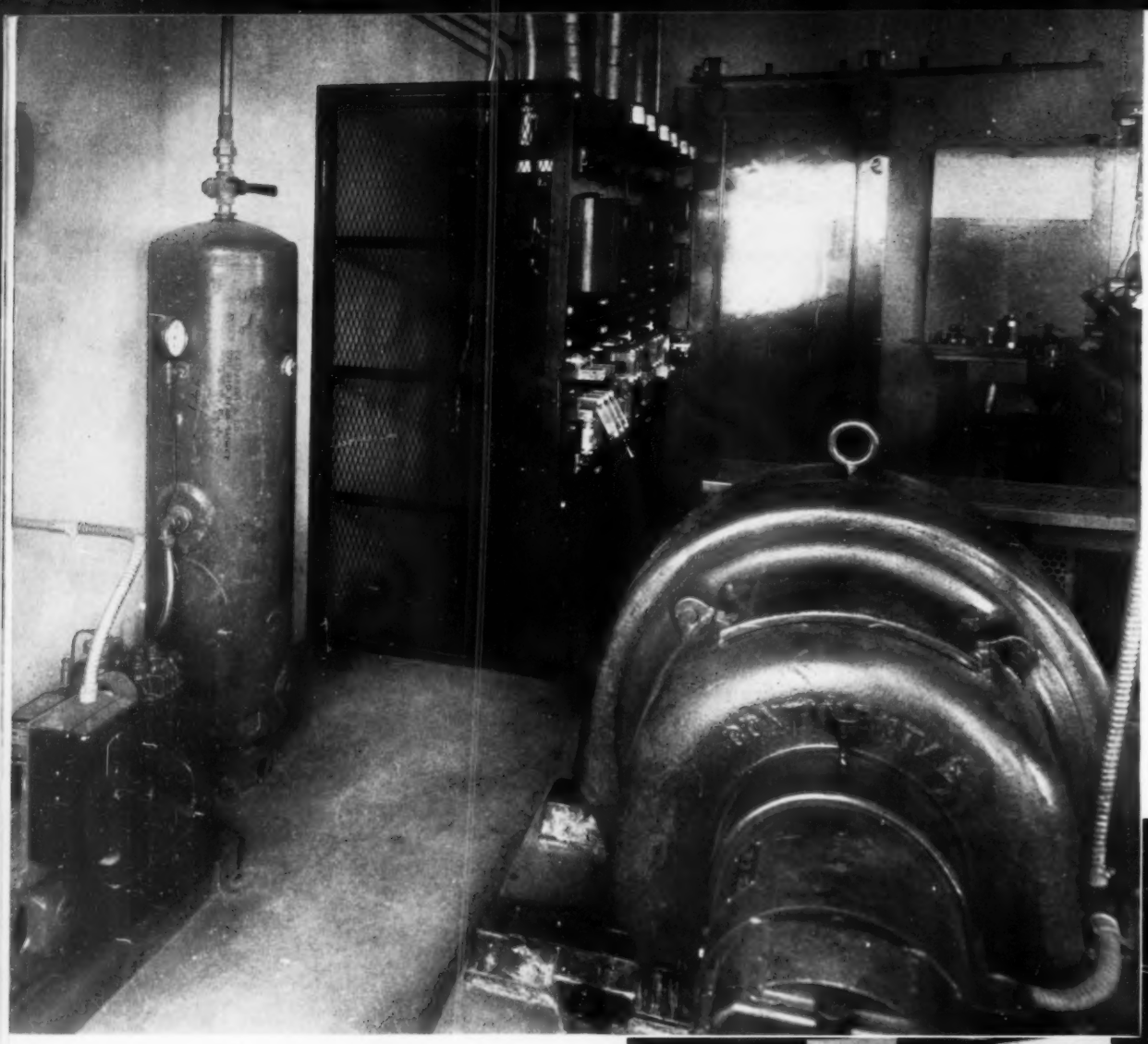
"To reduce this item of expense, Big Bear made a study of Diesel engines and finally came to the conclusion that a tremendous saving could be effected through the installation of Diesel-generating units. Big Bear, in its avowed campaign to constantly bring about lower prices to the consumer through lower operating costs, will doubtless eventually install Diesels in all its units."

Big Bear operates no less than eleven of these super-markets with more to come. What a far cry from "ye owlde country store" with its craker barrels and bags o' pru-ins!

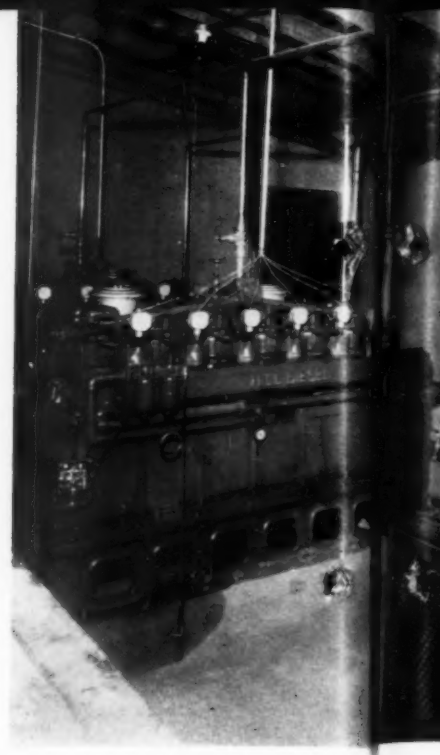
The Diesel-electric plant of the Paterson Big Bear Market consists of three Hill engines driving three Continental AC generators by means of V-belts. The Hill engines have a bore of five inches and a stroke of seven inches, two of them are of the six cylinder type furnishing power to two 50 kw. generators. These two sets carry the daily load for light and power. The third unit consists of a four cylinder Hill Diesel of the same bore and stroke as the six cylinder types, and this unit too drives a Continental AC generator by V-belts, the latter having an output of 35 kw. This unit is intended for the night load and for stand-by services.

The Hill Diesel engines operate at a speed of 800 rpm. while the AC generators turn at 1,200 rpm. This arrangement represents a satisfactory solution for a complex problem. As is well understood, a piston speed of 1,000 feet per minute should not be exceeded if engines are to be operated for continuous service. The Hill Diesel engines with a stroke of seven inches, operate well below the critical piston velocity of 1,000 feet per minute. A generator on the other hand, should operate at a high speed, and 1,200 rpm. requires a generator of but six poles whereas at a speed of 720 rpm., a 10 pole generator would be needed. Excessive bulk and cost is thus obviated.

The power plant installation at the Big Bear Market as executed by the engineering firm



Quincy air compressor and starting air tank in left foreground, switchboard with Alnor pyrometer in rear, and one of the Continental generators in right foreground.



Three Hill Diesel engin ernors, I equipped with Pierce go es. Am

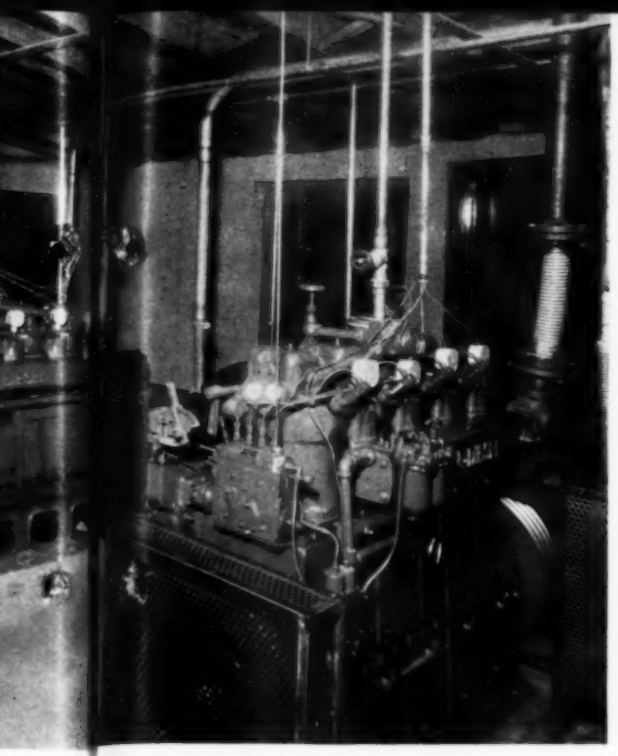
of Paszamant & Co., is compact, yet, provides for ample space for servicing the various units. The three Hill Diesel engines belted to Continental generators are placed in a row, thus occupying the minimum of space, yet are accessible on all sides.

The control board and the Quincy air-compressor unit are placed against a wall and are separated from the engines by a wide walk. The former is equipped with an Alnor exhaust temperature indicator, Frame frequency meter, Burlington voltage regulator, Sangamo watt-hour meter, Ward-Leonard field rheostats, as well as the usual volt and ammeters.

The Hill Diesel engines are started by compressed air. A pressure of approximately 290 lbs. per sq. in. is maintained within the air storage tank. The Quincy compressor is driven by a Century induction motor set in operation by a Cutler-Hammer starter.

The Hill engines are well protected, first by Alnor pyrometers (clearly visible in Fig. 3) which are connected by means of flexible tubing with the Alnor indicator mounted directly on the control board. In addition to this, the engines are equipped with Fulton-Sylphon automatic shut-offs. They operate in conjunction with the cooling water temperature, sounding an electric alarm when the water temperature within the engine's cylinder jackets reach a temperature of 160° F., and they shut the engines off completely should the water temperature climb to 175° F.

The engine equipment includes injection nozzles of Hill's own design and Bosch fuel pumps. The fuel oil is purified by a Purolator and is delivered to the engines by Teesdale automatic pumps. The lubricating oil must pass a Cuno filter on the suction side and a



sel engine ernors, Bosch fuel pump, and Purolator fil- Pierce go ers. American Metal hose on exhaust lines.

Continental generators belt-driven by three Hill Diesel engines equipped with Air Maze air filters and W. G. B. lube oil filters.

W. G. B. filter on the pressure side. An Air-Maze filter assures that none but clean air is drawn into the engine's cylinders and a Pierce governor maintains a uniform engine speed of 800 rpm.

While for the time being at least, the Diesel-electric plant is used only for the generating of current, it is intended to ultilize the waste heat from the engines to heat the building.

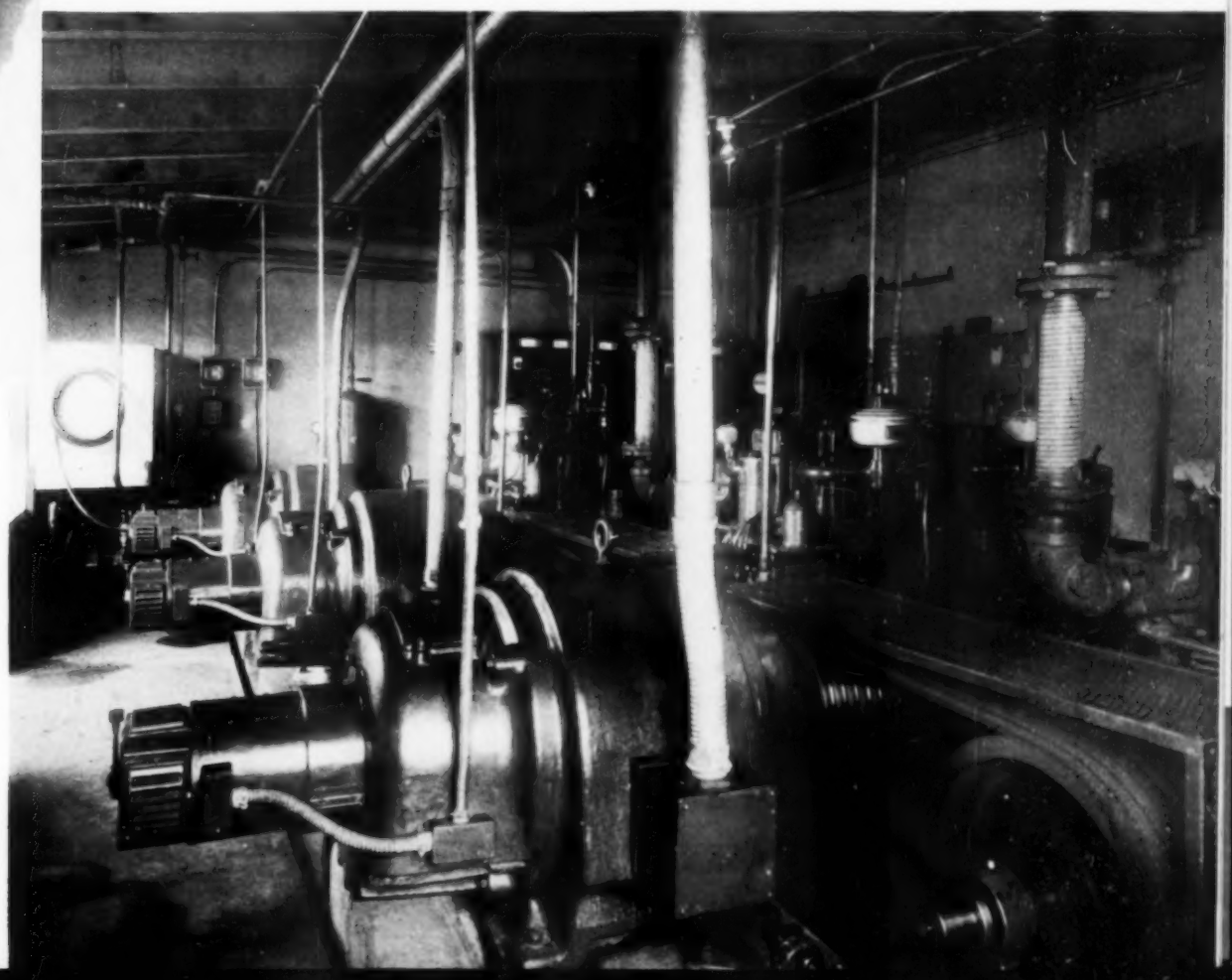
At this writing, the heat of the engine's cooling water is dissipated by means of a Binks cooling tower but of course, during inclement weather the heat thus dissipated may well be utilized for useful work, i.e., heating the building.

For this purpose, four Carrier Unit Heaters are being installed so that the heat of the engine's cooling water may be used to do a partial heating job. The four Carrier Units will be distributed within the building and electric fans will send the warm air all over the interior. The units and their fans will be so positioned that some of the warm air will be discharged along the walls and some toward the center of the building to overcome roof heat-dissipation losses.

While there is not sufficient heat available to thus heat the building in sub-zero weather, it does suffice for early fall and chilly spring days, and it is a decided aid even in mid-winter. It has been estimated that this "cost free' heating system saves fully $800.00 per year in either coal or fuel oil and it thus effects worth while economies.

Now, we may well illuminate the cardinal point of the entire illustration, i.e., the financial angle. It has often been asserted, usually by those who are biased for one reason or another, that small electric plants are a liability rather than an asset, that the cost of generating electricity is high unless it is produced in huge plants, and that the cost of the equipment is prohibitive and kindred nonsense. Let us see now just how much is truth and how much is fiction. In so far as this installation at the Big Bear Market is concerned, the total cost of the installation is roughly $25,000.00.

The electricity generated and used, would cost, if purchased from a utility company, an amount that exceeds the operating cost by $6,000.00! In simple language, this plant saves its owners just $6,000.00 per annum. The plant produces more electricity than the owners can use, hence they meter current to the United Parcel Service, located adjacently, for a flat charge of $100.00 per month, or $1,200.00 per year. Thus, a saving in current costs of $6,000.00 per annum, plus an income from metering current, of $1,200.00 per year, plus a saving of $800.00 per year in heating costs totals $8,000.00 per annum. Since the total plant cost is roughly slightly more than three times the yearly revenue, the plant thus pays for itself in a little over three years, and after that period it will produce a net revenue of a substantial sum for years to come.



FIFTY-SEVEN DIESEL ENGINES

Described in Detail by JOHN W. ANDERSON
Aviation Section by PAUL H. WILKINSON

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ADDITIONAL CHAPTER HEADINGS

(1) The Birth of the Diesel Engine
(2) Vibration Elimination
(3) Noise Elimination
(4) Flexible Connections
(5) Air Filtration
(6) Ponca City, Okla.
(7) Department Store Application Study
(8) Port Clinton, Ohio
(9) Sailors Snug Harbor
(10) Chicago Diesel Fire Boat
(11) 580 Fifth Ave., New York
(12) Mobile Ice Plant
(13) New York University
(14) Parke Davis Company
(15) Imperial Irrigation District
(16) LaPorte City, Iowa
(17) 8000 kw. Shanghai Plant
(18) 15,000 kw. Hydro Standby plant
(19) 22,000 hp. Mine installation
(20) Combination Hydro-Diesel-Steam
(21) French Community installation
(22) Paris, Texas, Observatory
(23) Langbein Cutlery Company
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Buda—all types
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Fig. 1. The Ph. Dietz Coal Company's Ice Plant

DIETZ ICE PLANT

By B. J. VON BONGART

THE Ph. Dietz Coal & Ice Company of Ridgewood, L. I., New York, has been a producer of ice for many years. The original steam power plant has been augmented by two Chicago Pneumatic Diesel engines.

The total plant capacity is some 300 tons of ice per day, of which 115 tons are produced with the power furnished by the Diesel engines. The total capacity as given is, of course, summer-production; for the winter months, a production schedule of 100 tons per day suffices for the normal demand. The commercial production of artificial ice calls for a 24-hour a day, seven-day a week production schedule; hence, operations never cease. The power plants are thus in constant operation and absolute reliability, insofar as the engines are concerned, is thus a prime requisite.

The summer demand for ice is so much greater than the winter requirements that the existence of a surplus of power is unavoidable for that period of the year when the demand for ice is at its lowest level. Yet, an ice plant to be commercially successful, simply must be prepared to handle peak production loads. The Ph. Dietz Coal & Ice Company meets this requirement in a simple manner. For the summer months, both the Diesel and steam engines are placed in service to carry the production load, whereas for the winter months, the steam engines are set at rest and the load is then carried by the Diesel engines alone. This, then, provides for a leisure period for the steam engines, boilers, etc., but the Diesel engines must carry on uninterruptedly.

The Diesel division of the power plant consists of two Chicago Pneumatic Type RHB-50 engines, a 6-cylinder developing 245 bhp. operating at 327 rpm. and a 5-cylinder engine of 185 bhp. turning at 300 rpm.

They are of the heavy-duty type and are especially designed for strenuous service, and intended for hard, continuous performance, such as industrial applications requiring uninter-

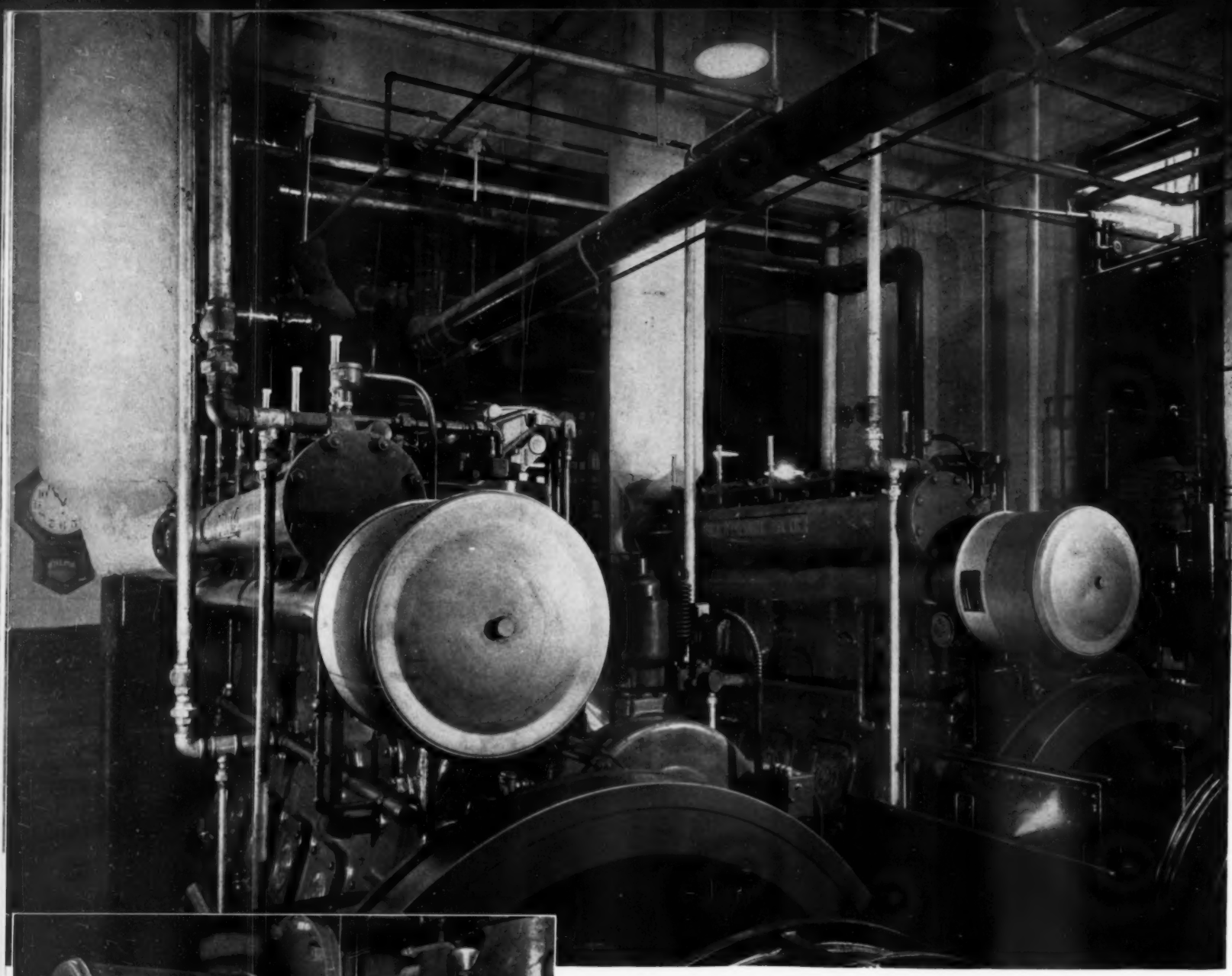


Fig. 2. Generator side of the Chicago Pneumatic Diesels, showing, in the background, the huge Maxim silencers used. Burgess intake silencers in the foreground.

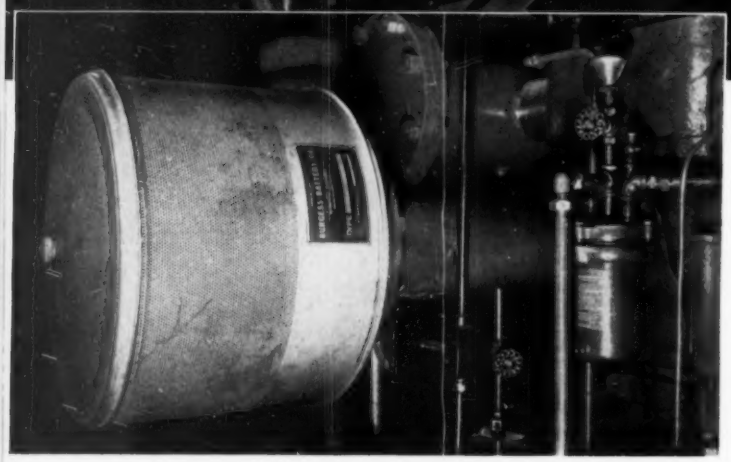


Fig. 3. Nugent Oil Filter Installation.

rupted power delivery. For their size, these engines, are what may be termed "medium speed engines," operating with a piston velocity considerably less than 1,000 feet per minute, which is conservative practice indeed.

As may be seen from Figs. 2 and 4, the power is produced and used in a straight line arrangement, devoid of belts and shafts. The Chicago Pneumatic Diesels are directly coupled to Electric Mach. Mfg. Co. 3-phase, 60-cycle generators and also to Frick ammonia compressors. The two Diesels together with their generators and compressors are set up as two complete self-contained units, side by side. It is a compact yet accessible arrangement and saves floor space.

The equipment furnished with the Chicago Pneumatic Diesel engines is what one would expect in connection with a well designed plant. Burgess Air Filters of ample capacity supply the engines with clean air. Huge Maxim silencers, extending vertically directly from the engines up to the roof of the building, effectively muffle the engine's exhaust.

The protective equipment safeguarding the operation of the Diesel engines has also received due consideration. Alnor pyrometers actuated by thermocouples installed in the engine give visible indication of the engine's performance. Viking Electric Safety Alarms operate in conjunction with the cooling water temperature.

The purity of the lubricating oil, an item of major importance in the successful and trouble-free operation of Diesel engines, is assured by Nugent and Michiana lubricating oil filters which provide clean, grit-free lubrication service.

The engines are started by means of compressed air furnished by a Curtis compressor. The control of the Chicago Pneumatic engines is exceedingly simple. A single hand wheel (Fig. 4) controls the starting and stopping of the

engines. There are four distinct positions in so far as control is concerned, namely, "Start," which admits compressed air to set the engine in motion; "Run," which causes the injection pumps to deliver fuel; "Stop," which curtails the fuel delivery, hence stops the engine; and "Release," the latter position not only stops all fuel delivery, but also lifts the exhaust cams, thus stopping the engine instantly.

The A.C. generators are of 94 kva., 240 volts at 226 amperes capacity, respectively, 62.5 kva., 220 volts at 164 amperes. While each of the two Chicago Pneumatic Diesels operates an ammonia compressor, the current produced by the A.C. generators, also directly coupled to the engines, is utilized to furnish current for two 40 hp. Western Electric induction motors driving two 7 x 7 Frick ammonia compressors. Current is also furnished for a 60 hp. U.S. electric motor driving a Sterling Unitype pump for the condensing of the ammonia.

The plant's control board, Fig. 5, is compact yet contains all of the necessary equipment for the operation of a Diesel-electric plant. The Cutler-Hammer field rheostats operate the D.C. exciters. Simplex voltage regulators maintain an even output for the A.C. generators. Roller-Smith volt and ammeters, as well as wattmeters, indicate the generators' output characteristics. The power plant of the Ph. Dietz Coal & Ice Company, being a dual-power plant, part Diesel and part steam, affords a unique opportunity to make observations and comparisons. That the Diesel engine is a prime mover, furnishing power at less cost and with fewer auxiliaries than a steam engine, is generally conceded. But its main feature, and one that is noticeable instantly, is its compactness.

The Diesel engine is a self-contained unit, sufficient unto itself in every detail, except for fuel, water and exhaust piping, all of them relatively simple and utterly devoid of maintenance difficulties or even attention.

Combining a Diesel engine, a generator and a compressor into one basic unit, again complete in itself, constitutes the acme of efficiency and compactness. Generating current by means of a Diesel-electric unit, on the other hand, provides for power that may ultimately be used most anywhere within a building or outside of it. The transmission of electricity to motors which may drive any and all sorts of machinery required within a given plant and for various purposes, is the simplest possible method for power distribution.

Fig. 5. Control Board and Air Compressor.

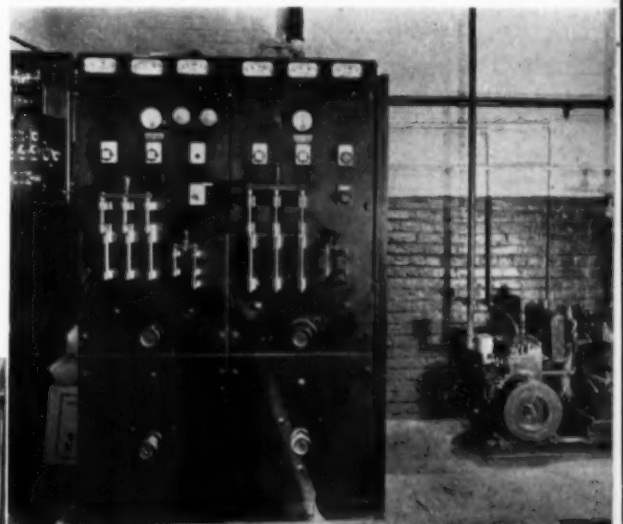
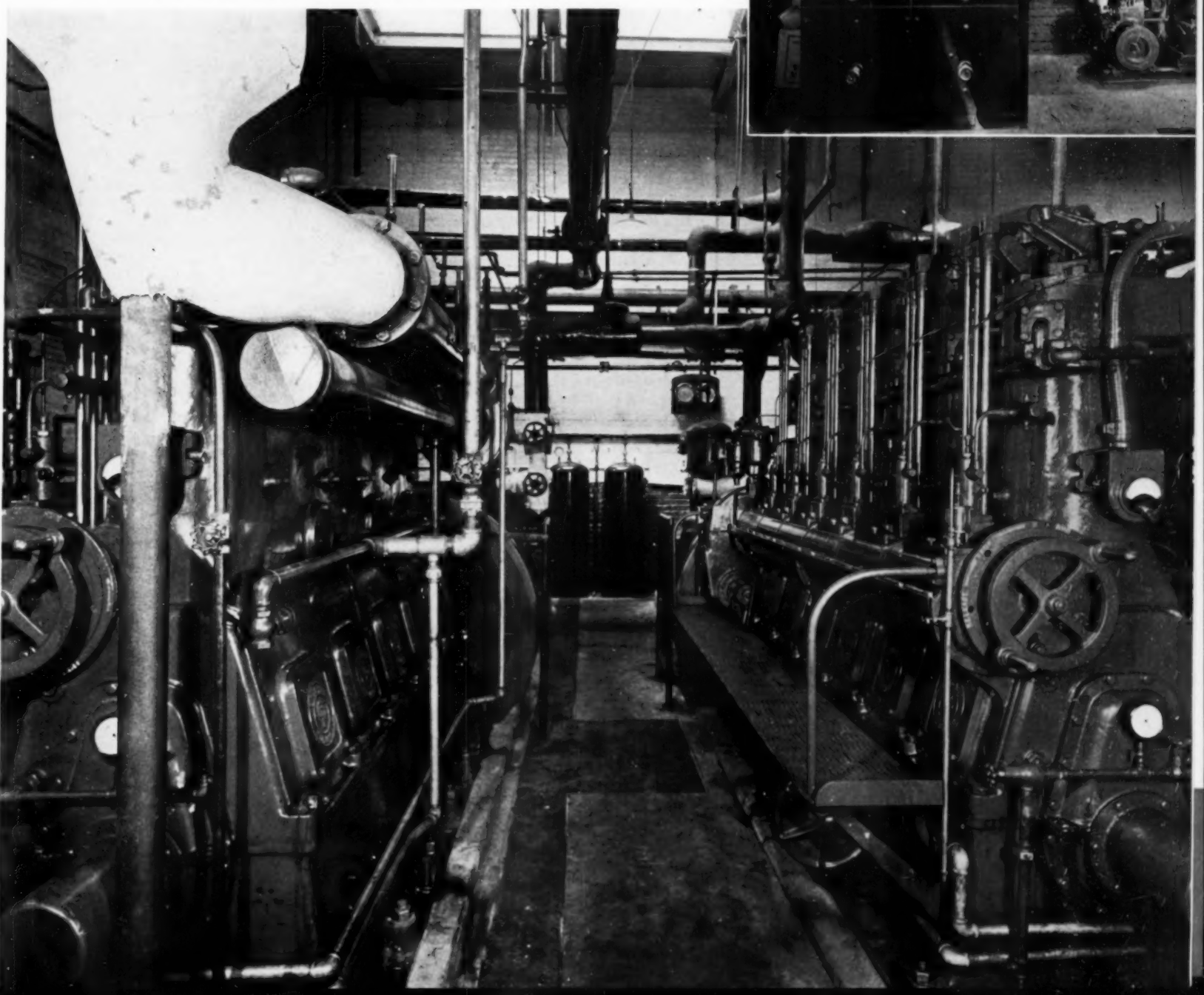
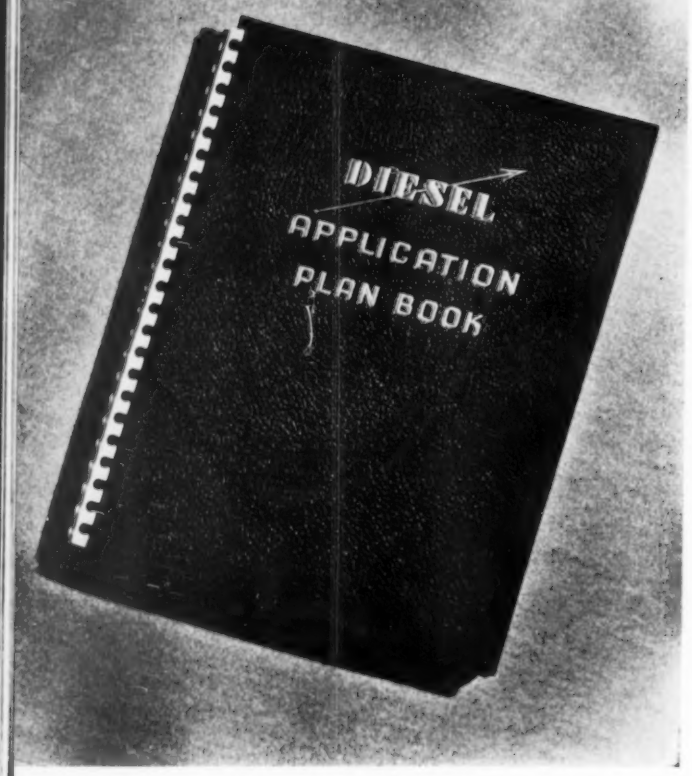


Fig. 4. Control side of the Chicago Pneumatic Diesels.





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61 Sewage Pumping Plant
62 Restaurant Power Plant
63 Fast Coastwise Passenger Ship
64 5700 kw. Power Plant
65 Pilot House Control by Mechanical Means
66 Diesel Driven Tender
67 117 ft. Survey Boat
68 Municipal Hydro and 1890 kw. Diesel Plant
69 15,000 Ton Tanker
70 600 kw. Municipal Power Plant
71 Self-Propelling Pipe Line Dredge
72 Quarry Power Plant
73 600 kw. Municipal Power Plant
74 Hopper Type Dredge
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76 Laundry Power Plant
77 Cotton Oil Mill Power Plant
78 1000 hp. Tunnel Stern River Towboat
79 1700 kw. Municipal Power Plant
80 Pipe Line Dredge
81 Marine Remote Controls
82 Sewage Pumping Station
83 450 kw. Floating Power Plant
84 Purse Seine Boat
85 1800 hp. Flour Mill Power Plant
86 3000 kw. Municipal Power Plant
87 149 ft. Ferry
88 Six-Wheeled Bus
89 State Park Power Plant
90 Resort Hotel Power Plant
91 700 hp. Tunnel Stern Tug
92 Diesel Electric Bus
93 Crane or Shovel Hookup
94 Elevator and Conveyor Drive
95 Semi-Portable Compressor Unit
96 2000 hp. Locomotive
97 7 Ton Locomotive
98 650 hp. Tug
99 Beam Trawler
100 300 hp. Tug
101 2000 kw. Factory Power Plant
102 80 ft. Ferry
103 480 ft. Tanker
104 30 Ton Locomotive
105 Semi-Portable Compressor Unit
106 Tropical Aviation Station
107 2000 hp. Locomotive
108 300 hp. Locomotive
109 FT Diesel Electric Ferry
110 Swimming Pool Pumping Plant
111 Cold Storage Warehouse Power Plant
112 Gold Mine Power Plant
113 Dredging Pump Drive
114 Radio Shielding
115 Cotton Oil Mill Drive
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121 Oil Well Drill Rigs

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NEW TWO CYCLE AUTOMOTIVE DIESEL

PRACTICALLY all automotive Diesel engines are of the 4-cycle type irrespective of whether the engines are intended for heavy truck or bus services or for light passenger car installation.

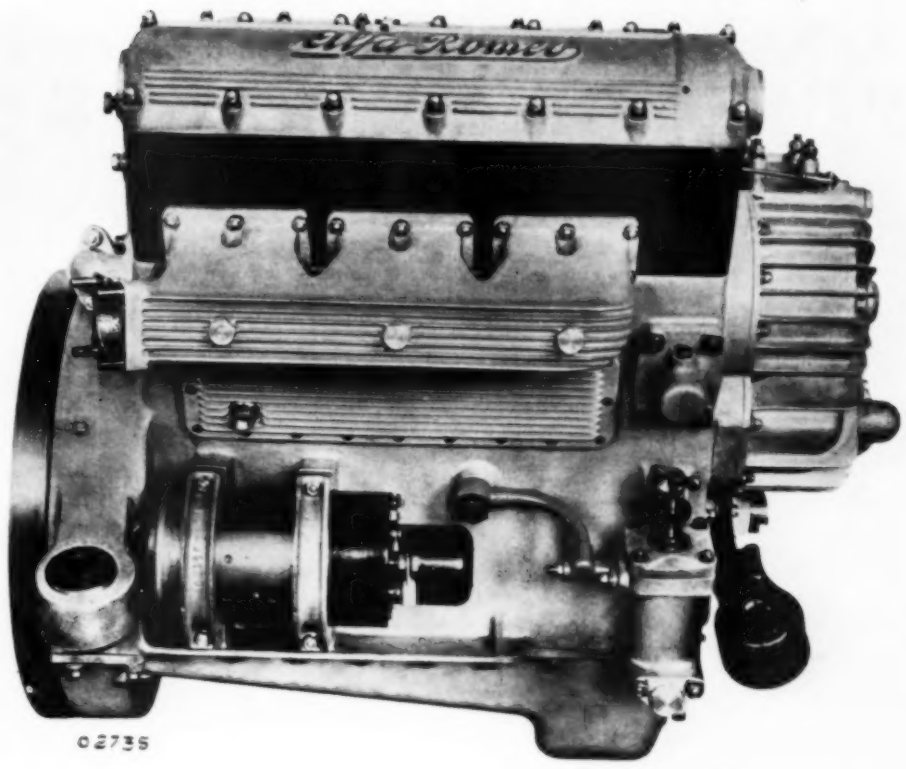
A departure from this concept is a European engine shown in Fig. 1. It is a 6-cylinder V-type, 2-cycle with port scavenging: the exhaust gases leaving via two poppet valves located in the cylinder head. A Root's type blower furnishes scavenging air at a pressure of approximately 4¼ lbs. per square inch.

The engine is of 3¾ in. bore and 5⅛ in. stroke, given a displacement of 337 cu. in. for the six cylinders. The crankshaft is of simple 3-throw layout, each throw accommodating a forked and a straight connecting rod from two opposite cylinders.

This type of construction results in a very compact unit, the fuel injection pump, set within the Vee (see Fig. 2), has short and direct piping to the injection nozzles.

The piston is made of an aluminum alloy but with a screwed-on head of stainless steel. The latter is cupped downward and thus forms the main combustion chamber which absorbs the

. . . . *And now please turn to page 58*



LEADERSHIP

AMERICAN-BOSCH is proud to be numbered among those who have contributed important achievements to the Diesel engine industry . . .

In pioneering—Based on the solid injection principle which made the high-speed Diesel practical, American-Bosch made a complete line of fuel injection equipment available in this country.

In proven performance—The many thousands of American-Bosch fuel injection systems now in use have earned an enviable reputation for flawless performance . . . have stood the all-important test of time.

In service facilities—A world-wide organization of competent authorized service stations is at the disposal of every user of American-Bosch fuel injection equipment.

Our 12 year background of experience is at your service.

UNITED AMERICAN BOSCH CORP.
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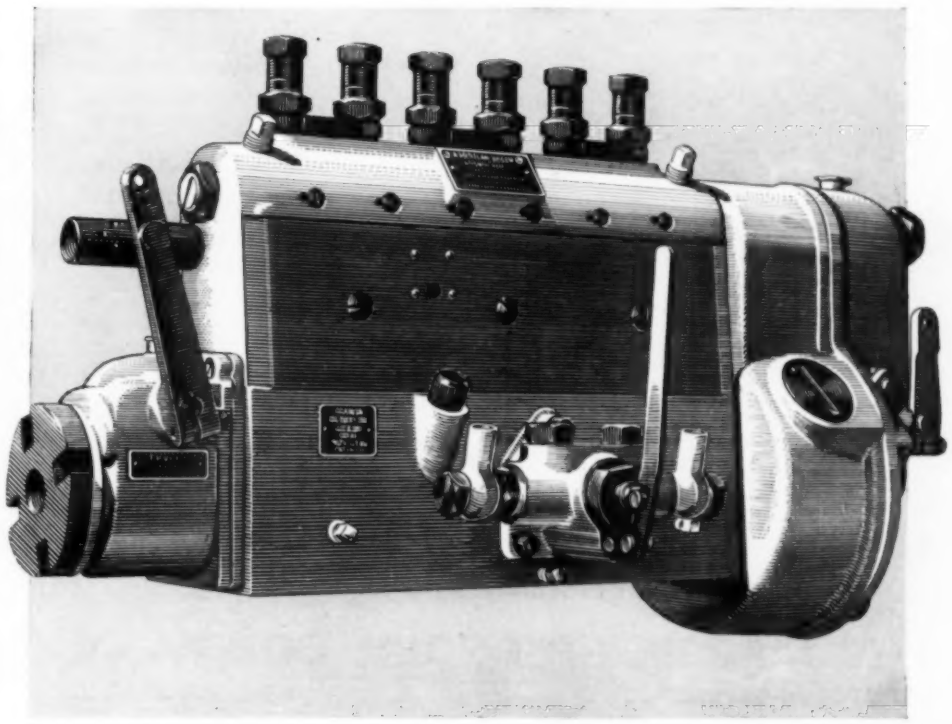
Fuel Injection Equipment



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CHICAGO PNEUMATIC TOOL COMPANY'S DIESEL ENGINES

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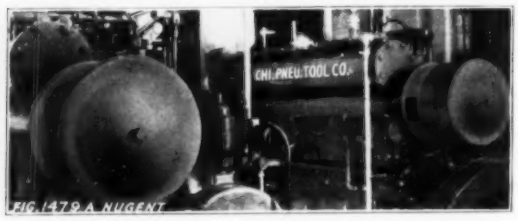

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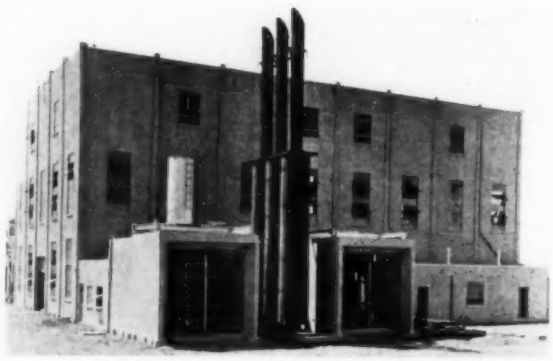

MAXIM DO4 SILENCERS AT PHOENIX

• Night and day these No. 48 Maxim exhaust silencers installed on the 7000 HP H. O. R. Diesel at Phoenix, Arizona, pay silent tribute to the foresight and thoroughness with which engineers planned this installation.

A MAXIM SILENCER is more than just a muffler –it is the result of years of experience and is positive assurance of a noise-free installation. Maxim *all steel* silencers are available for gasoline, Diesel, or steam engines, compressors, blowers, vacuum pumps, etc. It will pay YOU to insist on MAXIM.

For Literature Write to:

THE MAXIM SILENCER COMPANY
HARTFORD, CONNECTICUT **NEW YORK, N. Y.**

NEW TWO-CYCLE ENGINE

. . . . *Continued from page 57* . . . .

heat of the burning gases thus leaving the aluminum piston skirt containing four compression rings, relatively cool.

The connecting rods are long, 11½ inches center to center, which is about 4½ times the length of the crank radius. Crankpin bearings of connecting rods are equipped with "needle roller" bearings as are the closed "eyes" of the wrist-pin end of the connecting rods.

The crankshaft of the engines is very sturdy, all main bearings being 3.35 inches in diameter.

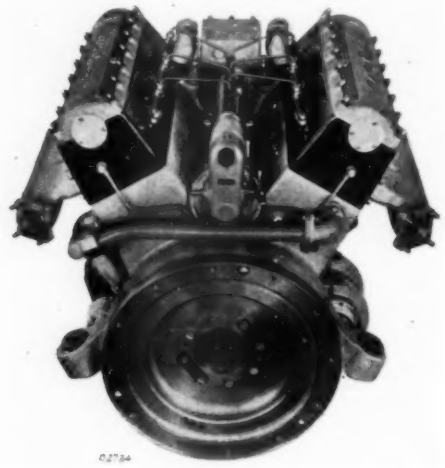

Fig. 2. Alfa-Romeo two-cycle automotive Diesel.

The two-valves in head construction permits uniflow scavenging which is almost a necessity for high-speed 2-cycle engines if piston overheating is to be avoided. The poppet type exhaust valves are not held by the usual circular springs but by "scissor springs" which reduce the over-all height of the engine considerably. The valves are actuated by an overhead camshaft rather than by means of the customary push rods and rocker arms.

The engine delivers close to 110 bhp. at a speed of 1,950 rpm. or 1 hp. per 3.4 cu. in. of displacement. This is a high rate of power for the relatively low engine speed (1,950 rpm.) and would indicate careful design.

The lubrication system provides for a dry sump and two oil pumps are employed. The oiling system is equipped with thermostatic control, and the normal oil pressure maintained is 50 lbs. per sq. in.

The engine is stubby indeed, but 37½ inches long over-all and its weight is given as 1,160 lbs. This engine represents a distinct step in automotive Diesel engines and further developments are being watched with interest.

CARL BEHN APPOINTED AMERICAN-BOSCH VICE-PRESIDENT

ACCORDING to an announcement by the United American-Bosch Corporation, Springfield, Mass., Mr. Carl Behn has been appointed a vice-president of the company and will be in charge of all sales divisions.

Mr. Behn comes to American-Bosch from the National Supply Company, in which he was Sales Manager of the Superior Engine Division and also Assistant to the Vice-President in-Charge-of-Operations of its engine plants at Philadelphia and Springfield, Ohio.

Previous to this he was connected with the Bosch organization from 1923 to 1936, serving in important capacities at Chicago and Detroit.

Born in Denver, Colo., Mr. Behn received his education in Colorado and Arizona and saw active service in the World War (40th and 42nd Divisions) as a First Lieutenant of Infantry. He is prominently active in various engineering societies and holds membership in the American Society of Mechanical Engineers and the Society of Automotive Engineers, serving as vice-president in the latter organization.

THE Columbia Electric Manufacturing Company has expanded its line of A.C. generators so that they are now in a position to furnish generators in sizes ranging from 1½ kva. up to and including 300 kva., in a wide range of speeds and suitable for direct connection to gas, gasoline, or Diesel engines.

These generators are available with direct-connected exciters or for excitation from an external D.C. source. When generators are furnished with direct-connected exciters, a special compounding type, automatic voltage adjuster is available. This adjuster will maintain the voltage within plus or minus five per cent for average load conditions. It has no moving parts, vacuum tubes, or contacts.

The fact that these generators are compact, Timken bearing equipped, and available with complete switchboards, has made them ideally suited for use in oil fields, construction jobs, airports and in locations where central station power cannot be had, or the price of it makes its use prohibitive.

Full details regarding these A.C. Columbia generators may be obtained direct from the Columbia Electric Manufacturing Company, 4503 Hamilton Avenue, Cleveland, Ohio, by mentioning DIESEL PROGRESS.

QUINCY COMPRESSORS in BIG BEAR MARKETS

See complete detailed story on pages 49, 50, and 51 in this issue

Model *DG-8* QUINCY AIR COMPRESSOR, *right*, supplies compressed air for starting two 6-cylinder 95 h.p. and one 4-cylinder 65 h.p. Hill Diesel Engines in Big Bear Market at Paterson, N. J.

BIG BEAR MARKET, *right below*, at Paterson, N. J., where new Diesel power plant installation was executed by engineering firm of Paszamant & Co.

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TIMKEN ROLLER BEARINGS
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SEMI-STEEL PISTONS
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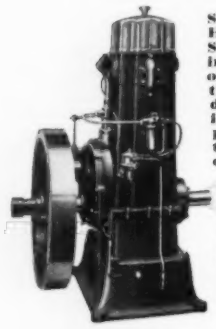
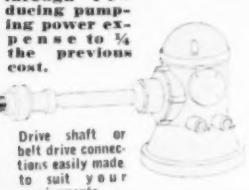
INVESTIGATE the efficient design and proven dependability of QUINCY COMPRESSORS. There is a complete line of models for every Diesel Air Supply duty. Write today for interesting, helpful FREE literature. QUINCY COMPRESSOR CO., Quincy, Illinois. *Branches:* New York, Chicago.

QUINCY Compressors

CUT YOUR PUMPING COSTS 75%



STOVER 5, 7½, 10 and 15 H.P. (honestly rated) DIESEL ENGINES are returning their original cost to owners, year after year, through reducing pumping power expense to ¼ the previous cost.



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STOVER DIESEL ENGINES have made all kinds of pumping more convenient and economical, on thousands of jobs, because STOVER DIESELS—

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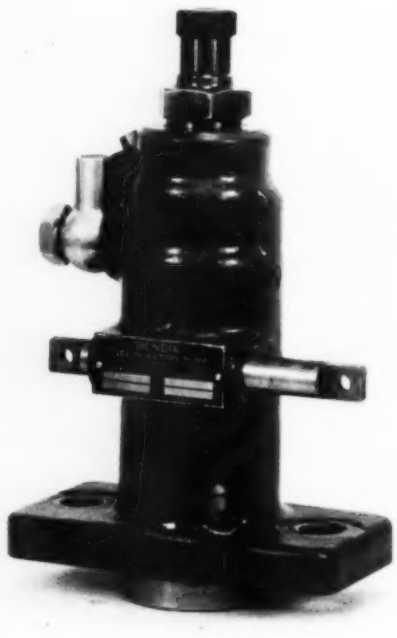
BENDIX FUEL PUMP. A SERIES OF SINGLE UNIT TYPES

BENDIX fuel injection pumps are of the port controlled type, built in single cylinder flange mounted units with standard mounting dimensions. They can be supplied in eight sizes, ranging from 10 mm. to 17 mm. plunger diameter with 15 mm. stroke. These pumps represent a distinct advance over previous injection equipment. They are the result of several years of intensive research and experimental work, backed up by over 15 years of practical Diesel engine experience. They are manufactured as a precision product by Scintilla Magneto Co., Inc., of Sidney, N. Y., whose high standards of workmanship are well known from its Bendix-Scintilla Aircraft Magnetos and ignition equipment.



Bendix Fuel Pump

The pump cylinder, driving tappet and control mechanism are housed in an alloy iron casing. The upper end of the cylinder has two ports arranged longitudinally. The upper port serves as the intake and the lower port as a by-pass. Each port opens a separate annular groove, machined into a stainless steel insert which surrounds the upper end of the cylinder, both grooves joining at the intake fitting. This design enables a uniform suction period to be obtained and prevents erosion of the pump casing from sharp surges during the by-pass period.

The plunger has on one side a simple helical metering groove with a ground upper edge. On the opposite side is a small helical lubricating groove. These grooves are connected to the upper end of the plunger by central and cross holes. The plunger and barrel construction results in an unusually effective seal at the ports and accurate metering over long periods of operation.

The quantity of fuel is controlled by a gear sleeve and rack of liberal proportions. The delivery valve is of the needle type, so proportioned that ample line pressure relift and sharp pressure drop are obtained. The tappet mechanism is light and made of carefully selected alloy steel. Spring retainers specially heat treated to improve their resistance to corrosion. The enclosed parts are lubricated at three points.

Bendix nozzle holders for use with the pumps just described are offered in six different lengths of shank.

Spray nozzles are supplied in two different types, permitting twelve different combinations

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Whatever the size of engine that may be required or if there is a preference of type or design, the extensive line of Nordberg Diesels permits the selection of the proper engine for each individual need. They can be had in sizes from 150 horsepower upward.

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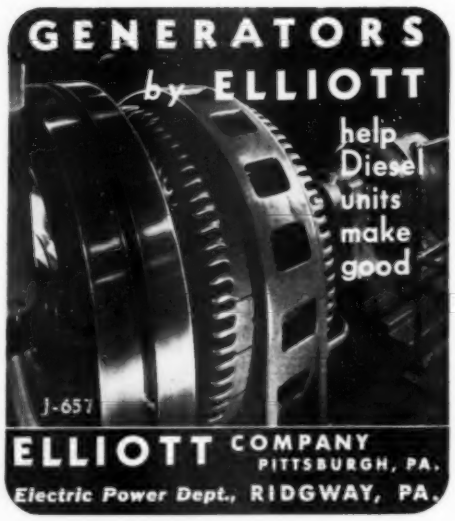


ELLIOTT COMPANY PITTSBURGH, PA.
Electric Power Dept., RIDGWAY, PA.

Bendix Spray Nozzles.

of nozzles and holders. Nozzles are of the differential type and are available either with spray orifices drilled directly into the nozzle body or with separate spray tips. The needle lift is limited by a steel plate, hardened and lapped.

An edge-type filter is provided, inserted in and part of the inlet fitting.

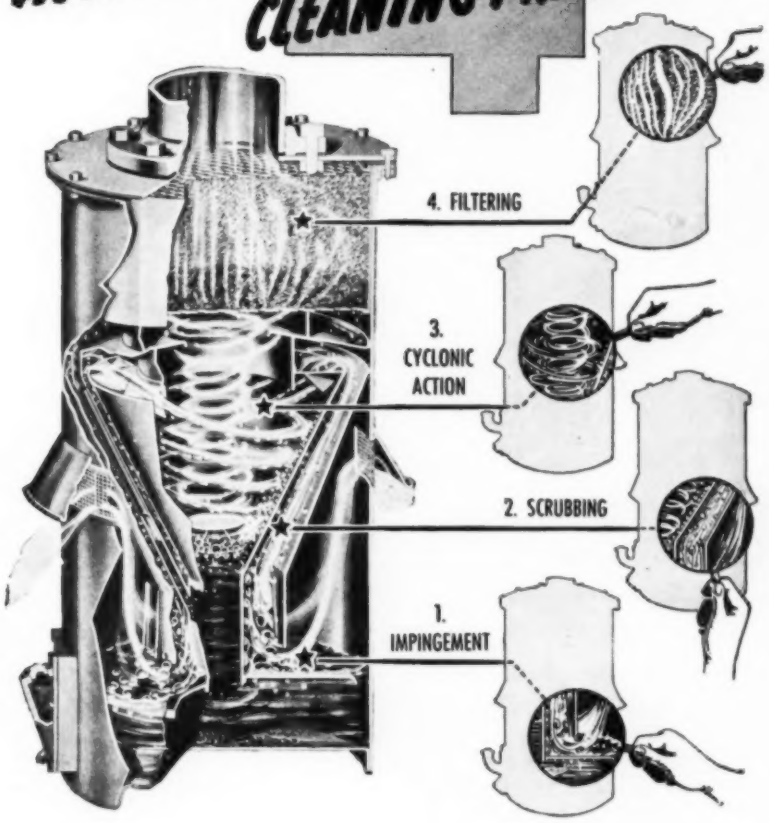
NEW BUDA PRESIDENT

AT the July meeting of the Board of Directors of the Buda Company, Harvey, Illinois, Mr. L. M. Viles, President for over 20 years, was elected to the position of Chairman of the Board. Mr. Dempesy, who has served the company for many years as Secretary, Treasurer, and Vice President, was elected President to succeed Mr. Viles. At the same time, Mr. F. E. Place, who has been associated with the Buda Company since 1908, retired as Senior Vice President. An executive committee, consisting of Mr. Dempesy and two Operating Vice Presidents, Mr. R. K. Mangan and Mr. E. D. Conant, will direct the affairs of the company.

HYDRAULIC COUPLINGS

THE Hydraulic Coupling Division of the American Blower Corporation has recently produced an interesting and informative folder on traction type hydraulic couplings. Many of our readers will undoubtedly find this data of considerable value. Hence we suggest that you communicate directly with the Hydraulic Division of the American Blower Corporation, 632 Fisher Building, Detroit, mentioning DIESEL PROGRESS, and asking for this folder.

CYCOIL OIL BATH AIR CLEANER HAS FOUR CLEANING PRINCIPLES



POSITIVE protection against oil contamination and wearing of motor parts due to dust and grit is assured when engines are equipped with the new Cycoil Oil Bath Air Cleaner. Not just one or two—but *four* distinct cleaning operations are available in the Cycoil. This guarantees a continued self-cleaning action due to the fact that all large dust particles including lint are removed by a cyclonic action which also provides higher cleaning efficiency.

Write for bulletin No. 130-A for complete information.

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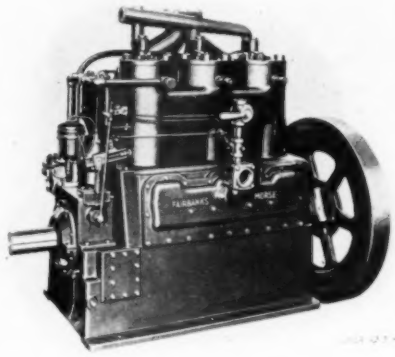
NEW GAS AND OIL ENGINE FOR OIL-WELL PUMPING IS INTRODUCED BY FAIRBANKS-MORSE

A NEW Fairbanks-Morse two-cycle, vertical, convertible gas and oil engine, the Model 34-AC-6, has been developed to meet the particular requirements of oil well pumping. It is a medium weight, heavy-duty pumping engine built for continuous service. The speed, ranging from 300 to 850 rpm., is governor controlled, and the power output is high. Smooth operation and combustion as desired for oil well pumping is obtained by a heavy flywheel and by a special governor arrangement that provides the correct degree of sensitivity to suit the load characteristics.

The two-cycle principle of operation, pioneered by Fairbanks-Morse, assures maximum dependability with minimum attention, characteristic economy and uninterrupted service.

Low overall height satisfies requirements for accessibility and limited head room on high foundation structures. Top movement and excessive vibration is eliminated. When installed on structurals, steady operation without vibration is assured by correct counter-balancing. The lower base construction is such that in most cases installation on previously designed structurals is possible without special rails.



The F-M Model 34-AC engine can be furnished with either standard or reverse rotation and with power take-off on either end to meet various operating requirements. These features enable the engine to be installed with the operating side accessible in driving single or double reduction, and for left-hand or right-hand drive gears. The close position of the power take-off sheave allows placing the engine symmetrically and usually without "outriggers."

Principal parts are interchangeable on oil and gas engines, as well as on the two-and three-cylinder units, giving the operator maximum flexibility in applying units at various pumping locations.

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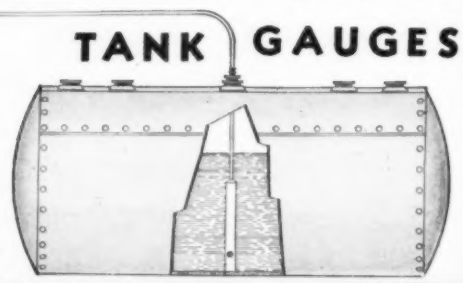

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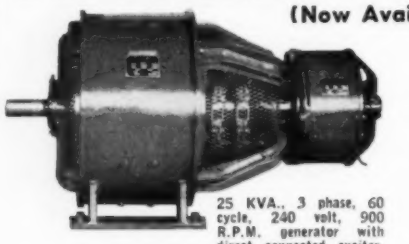

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GENERAL FOODS ORDERS 2 DEEP-SEA TRAWLERS

NEW YORK, June – Contracts for two additional super-trawlers for General Foods' "College Fleet" have just been awarded to the Fore River plant of the Bethlehem Shipbuilding Corporation, Clarence Francis, President of General Foods Corporation, announced.

The new Diesel-engined boats will cost in excess of $500,000 and will be identical to General Seafoods' *Annapolis*, *West Point* and *Yale*, which slid down the Fore River plant ways last September in New England's first triple launching of fishing vessels. The new ships will be christened the *Harvard* and the *Princeton*. Anticipated launching dates are September 15 and October 15. Each vessel will be powered with a 650 hp. Cooper-Bessemer Diesel engine.

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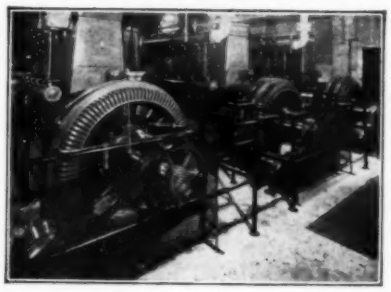

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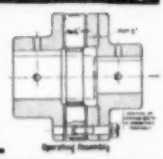

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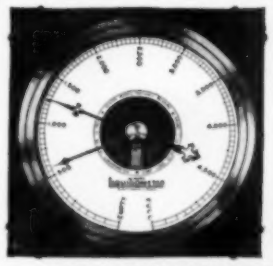

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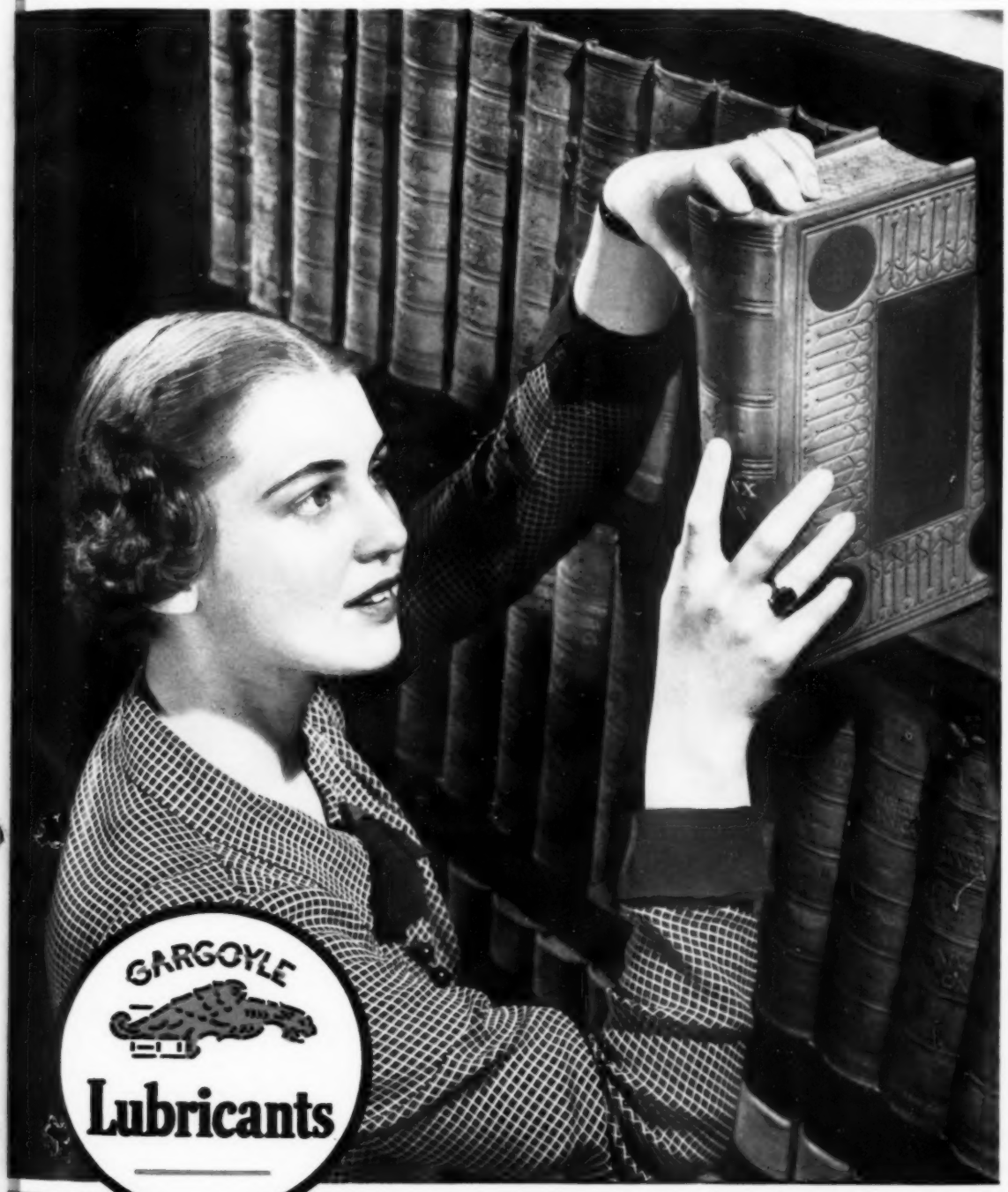

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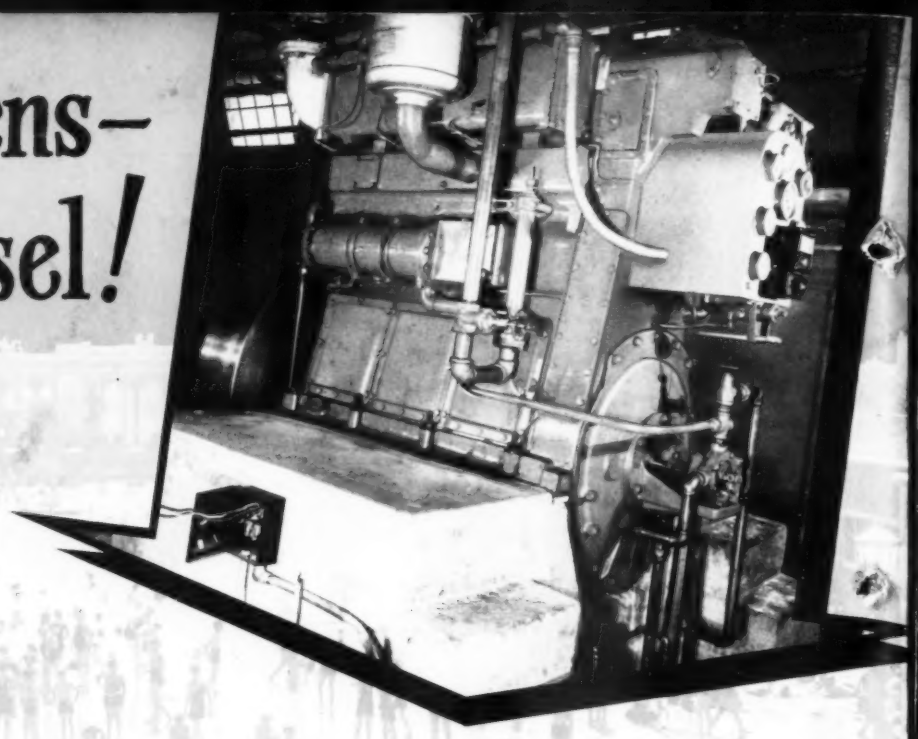

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